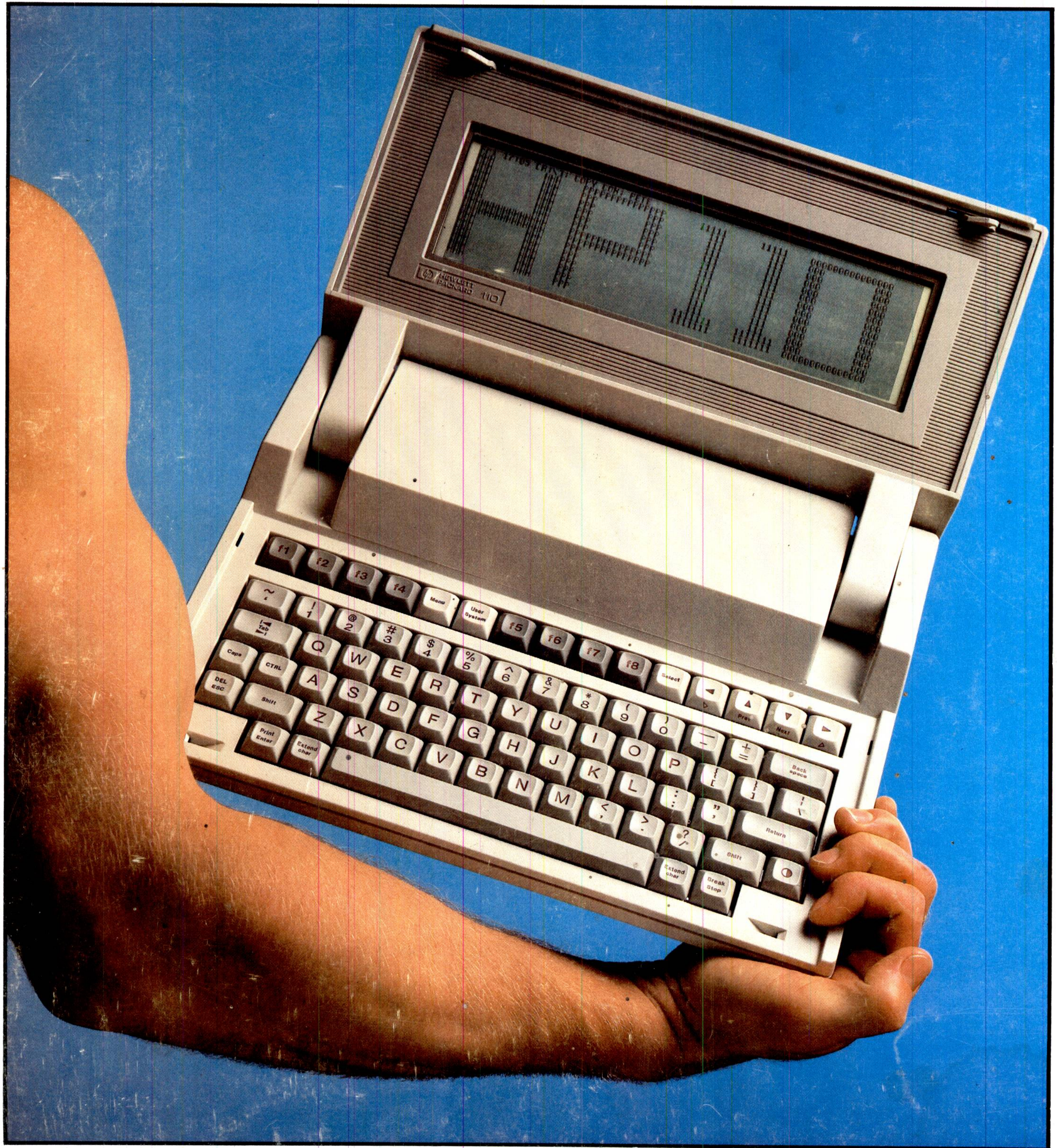
Personal Computer World

Canada $2.75/US $2.50/FF 18.50/FL 8.15/SFr 8.00/IR £1.41/BFr 99.00/
Lire 4,700/DKr 24.00/DM 9.5

July 1984 85p

Win an Epson PX-8

BRITAIN'S BIGGEST MICROCOMPUTER MAGAZINE

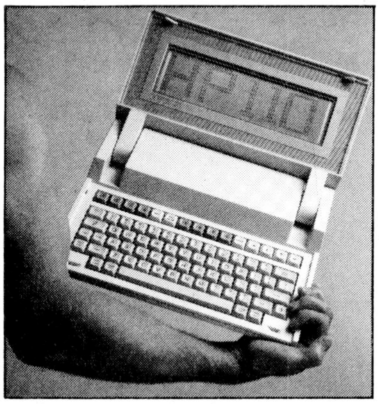


HP110 More power to your elbow?

Exclusive Benchtest of Hewlett-Packard's new portable

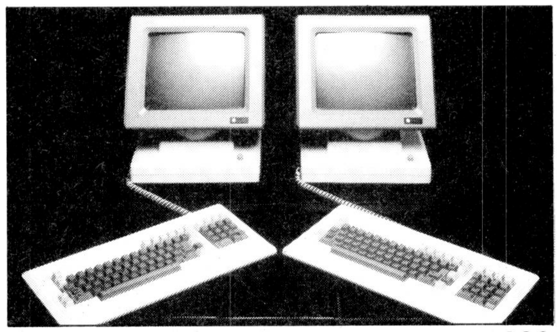
CONTENTS

Vol 7 No 7 July 1984



Cover photograph by Crispin Thomas

BENCHTESTS & REVIEWS



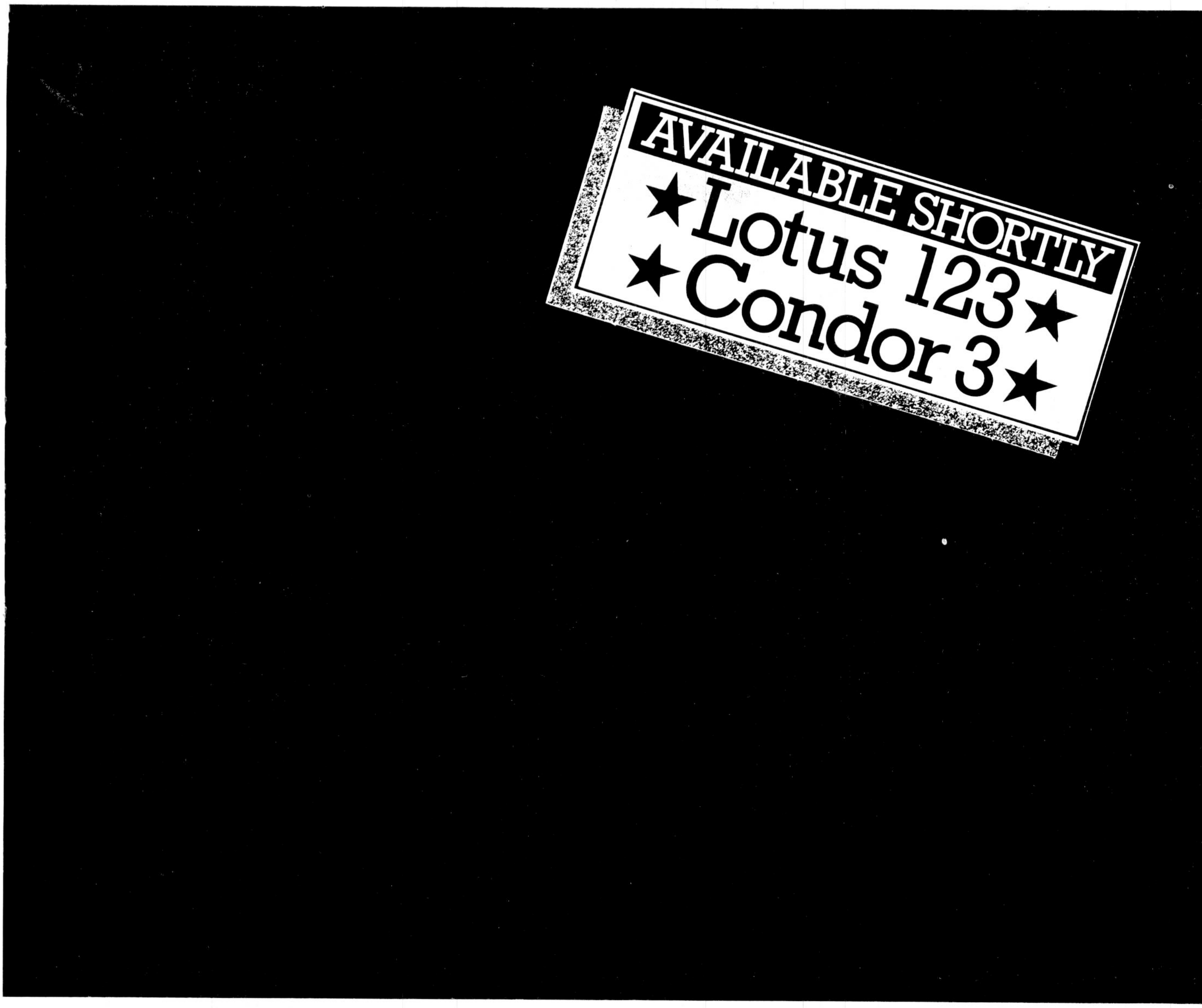
FEATURES

Founder Angelo Zgorelec **Editor** Jane Bird **Features Editor** Jerry Sanders **Production Editor** Ginny Conran **Sub Editor** Lauraine Danker **Programs Editor** Surya **Home Computing Editor** Tony Hetherington **Business Computing Editor** Peter Bright **Consultant Editors** David Tebbutt, Dick Pountain **Editorial Secretary** Tracy Dear **Group Art Director** Jim Dansie **Art Editor** Peter Green **Assistant Art Editor** Paul Ballard **Typesetters** Meadway Graphics 198 Victoria Road Romford Essex **Group Publisher** John Cade **Publisher** Tony Harris **Publishing Manager** Helena Sturridge **Group Advertisement Manager** Mike Carroll **Advertisement Manager** Peter Goldstein **Assistant Advertisement Manager** Philip Pratt **Sales Executives** Nicky Start, Gaye Collins, Claire Rowbottom, Brad Scott, Sarah Musgrave, Seema Ahya **Advertisement Assistant** Amberley Catanach **Advertisement Production** Tony Keefe **Production Assistant** Bev Grice

FEATURES

REGULARS

PCW Subscription Enquiries Stuart Cruickshank **Subscription Rates** UK: £15, Overseas £40 **Subscription and mail order address** 53 Frith Street, London W1A 2HG, tel: 01-439 4242 telex 23918 VNUG **Editorial and advertising address** 62 Oxford Street, London W1A 2HG, tel: 01-636 6890. Printed by Chase Web Offset, St Austell, Cornwall. Distributed by Seymour Press, 334 Brixton Road, London SW9, tel: 01-733 4444.



Now Available
"APRICOT XI"
5MB + 10MB
FROM
£2695 + VAT

TAKE ADVANTAGE OF OUR

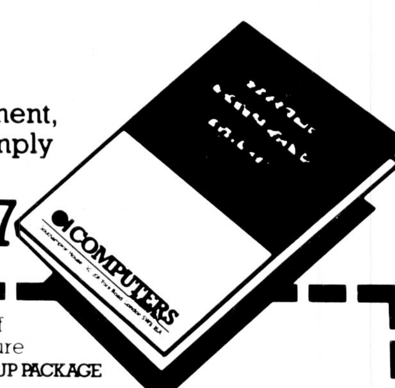
COMPUTER CLINIC
Hot line EXT.66

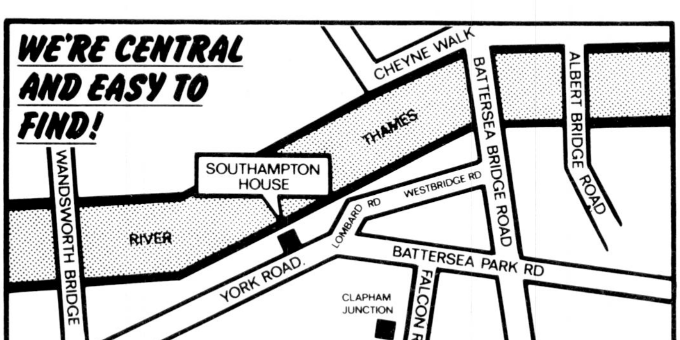
Any performance or technical question answered without obligation.

* User training for you and your staff.
* Easily arranged credit terms.
* Sophisticated technical and service back up.

Call us for an appointment, sales/mail order, or simply drop in!

01-228 2207





Please send me a copy of your introductory brochure and details of the **START UP PACKAGE**

Name ____________________

Address ____________________

____________________ Tel No: ____________________

Occupation ____________________ PCW/7/84

Southampton House, 192-206 York Road, London SW11 3SA

WHAT RESOLUTION FOR ONLY £230. (EX.VAT)

Our RGB high resolution colour monitors (580 × 470 pixels) sell for £229.95 (excluding VAT)–a saving of over £100 compared to other leading monitors of similar specifications.

That's a bargain we guarantee you won't see from any other micro retailer.

We've managed to acquire the sole distribution rights enabling us to offer these superb monitors at this unbeatable price.

And just because you're saving on price doesn't mean you're sacrificing quality. Here's what Personal Computer News had to say about our monitors.

"There is no doubt that the JVC range of ECM colour monitors is excellent value for money...there is no loss in quality of picture after long periods...remember as more and more resolution is available with new micros, the need for a better display will be that much greater."

For those who only require medium resolution we also have a model (370 × 470 pixels) at £179.95 (excluding VAT) which is equally excellent value for money.

Both units have a 14" screen and are suitable for the BBC Micro, Sinclair QL, Lynx, Oric, Apple, IBM, the Electron and most other leading micros.

And naturally there's a years full guarantee.

Another one of our commitments is to make certain we deliver your monitor by courier within ten days of receiving your order.

You can order by filling in the coupon below and posting to: Opus Supplies Ltd., 158 Camberwell Road, London SE5 0EE. Or by telephoning 01-701 8668 quoting your credit card number. Or, of course, you can buy at our showroom between 9.00–6.00pm, Monday–Friday 9.00–1.30pm, Saturday.

MODEL REFERENCE	1302-2 High Resolution	1302-1 Medium Resolution
RESOLUTION	580 x 470 Pixels	370 x 470 Pixels
C.R.T.	14"	14"
SUPPLY	220/240v. 50/60Hz.	220/240v. 50/60Hz.
E.H.T.	Minimum 19.5kv Maximum 22.5kv	Minimum 19.5kv Maximum 22.5kv
VIDEO BAND WIDTH	10MHz.	6MHz.
DISPLAY	80 characters by 25 lines	80 characters by 25 lines
SLOT PITCH	0.41mm	0.63mm
INPUT: VIDEO	R.G.B. Analogue/ TTL Input	R.G.B. Analogue/ TTL Input
SYNC	Separate Sync on R.G.B. Positive or Negative	Separate Sync on R.G.B. Positive or Negative
EXTERNAL CONTROLS	On/off switch and brightness control	On/off switch and brightness control

To: Opus Supplies Ltd., 158 Camberwell Road, London SE5 0EE.
Please send me:

______ High Resolution Colour Monitor(s) at £229.95 each (ex. VAT).

______ Medium Resolution Colour Monitor(s) at £179.95 each (ex. VAT).

______ Connection lead(s) at £6.00 each.

I understand carriage per monitor will cost an extra £7.00. (N.B. A High Resolution Monitor including VAT, lead, and carriage costs £279.39. A Medium Resolution Monitor including VAT, lead and carriage costs £221.89).

I enclose a cheque for £______ Or please debit my credit card account with the amount of £______ My Access/Barclaycard (please tick) no. is______

Please state the make of your computer______

Name______

Address______

______

Telephone:______

Opus.
Opus Supplies Ltd.

PW16

Add a modem to your computer and you've opened up a new dimension of data comms possibilities. Choose the WS2000 and these possibilities stretch world-wide!

The control panel tells you
WS2000 operates on both British/European and Bell (USA) standards – covering virtually global requirements. The mode selector is switchable between 300/300, 600, 1200, 1200/75 and 75/1200 speeds.

Provides database entry
WS2000 gives you access to Prestel, Micronet, BT Gold and the galaxy of bulletin boards that exist for enquiring micro users (with WS2000 modems!).

What the press says
'The best value for money in the modem field is without doubt the Minor Miracles WS2000' – Quentin Reidford, APPLE USER.

'A very versatile device, representing good value for money' –Peter Tootill, PCW.
'The Minor Miracles WS2000 modem could turn out to be the peripheral you can't live without' – Ralph Bancroft, PCN.

Add-on options
AA1 answer board £44.85 (inc VAT & P/P) – lets you dial out from your computer under software control and lets WS2000 answer your telephone and put your computer on-line in your absence. **ML1 modem/computer lead £8.05** (inc VAT & P/P) – please specify plug, eg 25-pin DB male. **CL1 software control lead £10.92** (inc VAT & P/P) for BBC Micro only. **CL2 software control lead £8.63** (inc VAT & P/P) modem end connector only.

Outstanding Modem
WS 2000: the leader for versatility, quality and price.

WS2000 complete with BT modular line plug and socket and full instructions for only

£129.95

plus VAT & P/P – £152.50.

Send in your order today!

Order by cheque/Barclaycard/Access to:
Miracle Technology (UK) Limited
PO Box 48, Ipswich IP4 2AB
Tel: (0473) 50304
Registered in England No 1756137

Trade enquiries invited

MIRACLE TECHNOLOGY (UK) LTD

3 TIME-SAVERS

CACHE

MicroCache is a highly intelligent disk buffering system (cache) that dramatically boosts the performance of your microcomputer. It is totally transparent to the user, automatically monitoring your use of disks and quickly 'learning' what to hold in RAM. In this way disk accesses are very substantially reduced, saving you time and reducing frustration. **MicroCache** is available for most CP/M and MSDOS machines including IBM, Sirius, Apricot, DEC, NEC etc.

PRINTER BUFFER

Also included in **MicroCache** is a printer buffer. This enables printing to apparently occur immediately by 'printing to RAM'. Actual output to the printer occurs in background mode without delaying the user. The RAM used by the disk cache is dynamically shared with the printer buffer; whichever is causing you most delay automatically gets the most RAM. This is a much more cost-effective way of saving time than purchasing expensive add-on printer buffer boxes.

RAM DISK

Silicon Disk is the original 'RAM-disk'. It provides you with an extra 'disk' in RAM which is extremely fast and reliable. As with **MicroCache,** the **Silicon Disk** software will operate with any RAM that is suitable for your machine.

MicroCache	
(including printer buffer)	£195
Demonstration copy	£25
Silicon Disk	£95

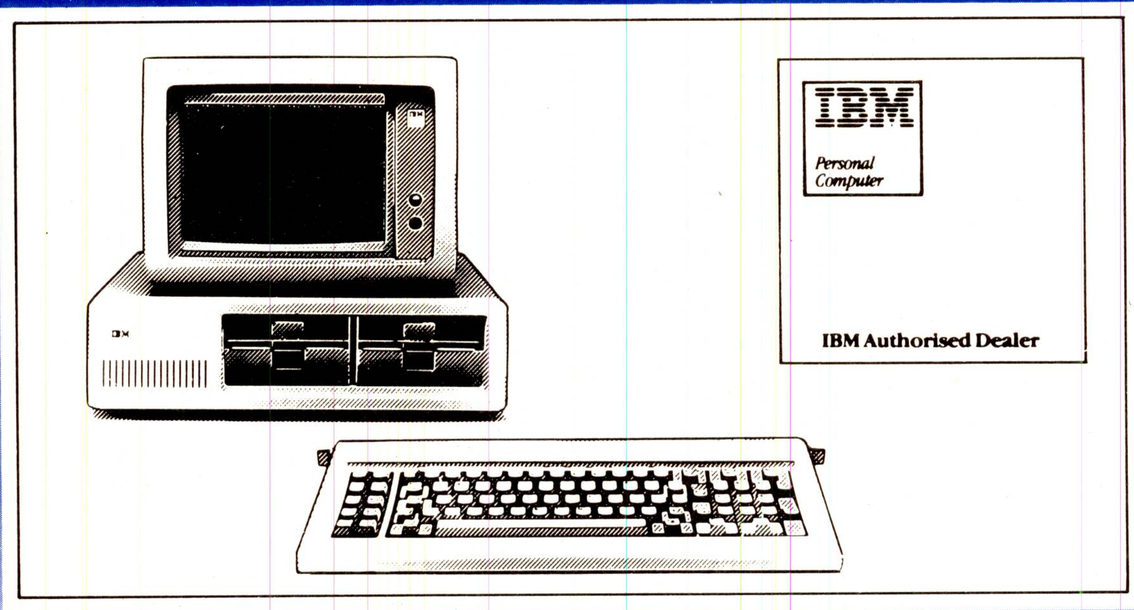
WARNING: ONCE YOU HAVE TRIED THESE PRODUCTS YOU WILL NOT BE HAPPY USING YOUR MACHINE WITHOUT THEM.

microcosm research

26 DANBURY STREET
LONDON N1 8JU
ENGLAND
TEL: 01-226 9092
TELEX: 24263 TARDIS G

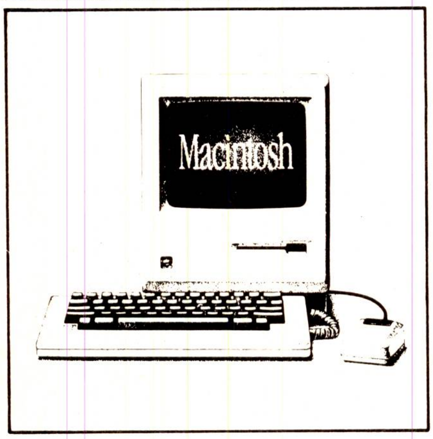
Rent, Lease or Buy from The Professionals

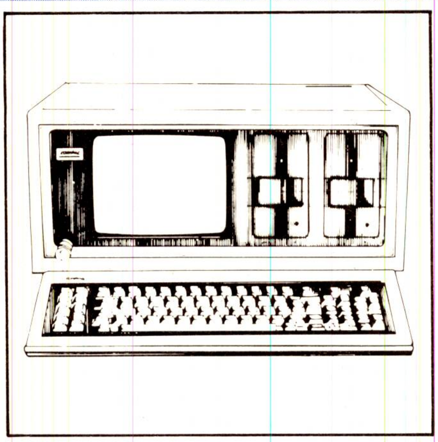
We are at the
PC USER SHOW
All You Need To Know About IBM Personal Computing
LONDON NOVOTEL LONDON W6 8DR 3, 4, & 5 July 1984

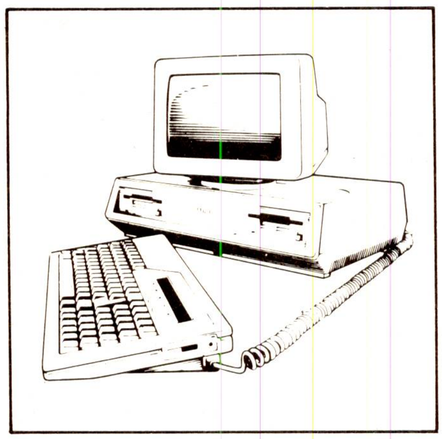


Authorised Dealer

Authorised Dealer







Macintosh COMPAQ apricot

See our extensive software library including Lotus 123, Open Access etc.

SILICON VALLEY COMPUTER CENTRE have highly trained professional staff to give you expert advice in Computer Accounting, Networking, Database Applications, Word Processing and a complete on-site maintenance service.
Call us today to discuss the right solution for your business.

silicon valley
COMPUTER CENTRE

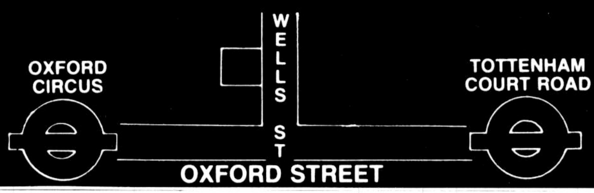
164 Grays Inn Road, London WC1. Tel: 01-833 3391
Manchester – Tel: 061-228 1686
Manchester office not authorised dealer

apricot — THE UK WORLDBEATER

TWIN FLOPPY
OR
5Mb HARD DISK
OR
10Mb HARD DISK

FOR THE BEST DEAL CALL 01-580 5522

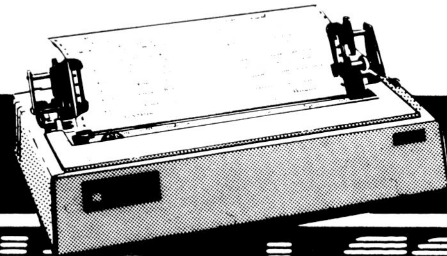
OR Call in . . . just 2 minutes from Oxford Circus



S-E COMPUTING LIMITED
LONDON BUSINESS CENTRE
(2nd FLOOR), 77-79 WELLS STREET
LONDON W1P 3RE

Hyperion — THE EXECUTIVE'S COMPUTER

PORTABLE, POWERFUL
AND PC COMPATIBLE
256K, 16-BIT 2 × 320K 5¼″
DRIVES
Includes:
MS-DOS, BASICA,
ASSEMBLER, ALADIN,
CARRY-CASE



Which PRINTER FOR What COMPUTER?

Micro General the Specialists for Printer Selection

Contact us for our expert advice on all your Interfacing problems

It's not just a question of plug in and lets go. There are now over 200 different connector situations. How do you know that your computer will accept the printer of your choice? We at Micro General do not sell boxes off the shelf. As computer engineers we help you to choose and install the right printer for your computer. The advice is free and it could save you some embarrassing mistakes – Buy from us for peace of mind.

2 YEAR WARRANTY NOW AVAILABLE ON SELECTED PRODUCTS

ACT APRICOT now with a built-in hard disk from 5 MBytes!

A superb personal computer that's easy to use and is fully integrated with powerful software which is simple and friendly – REQUIRING NO SPECIAL SKILLS TO USE IT EFFECTIVELY.

- Powerful 16 BIT multi processor Architecture
- Memory – 256 Kbytes standard, expandable to 768 Kbytes
- Portable – with built in 2 LINE LCD MICROSCREEN
- **NEW** JACKET-PROTECTED 3.5" diskettes
- Detachable keyboard with Calculator/Calendar/Clock
- Superb Software – 1000 existing packages will run on Apricot.

Complete Starter Package

available from under £16 a week

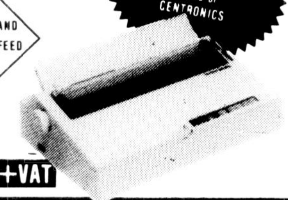
call for Finance Terms.

BROTHER HR15 DAISY WHEEL

- Diablo code compatibility
- 3K Buffer
- 2 colour printing
- Super & Sub Script
- Auto underline
- Proportional spacing

LOW COST TRACTOR FEED AND AUTO CUT SHEET FEED AVAILABLE

£399 +vat RS232 or CENTRONICS



PLUG-IN KEYBOARD OPTION – £150+VAT

NEW BROTHER HR5 MATRIX PRINTER

- Light and compact
- 30cps - very quiet
- Thermal or normal paper
- A4 or roll paper
- Bit image/Block graphics

£156 +vat

TRADE or PRIVATE CUSTOMERS take advantage of our

INTERFACING CONSULTANCY

INTERFACES & CABLES AVAILABLE FOR:

VIC 20	DRAGON
PET	COMMODORE 64
SPECTRUM	TANDY
ATARI	SHARP
BBC	OSBORNE
APPLE	SIRIUS
NEW BRAIN	SAGE
ORIC	and more!

INTERNAL & STAND ALONE BUFFERS from £65+VAT

PRINTER SWITCHES from £85 plus VAT.

CALL US FOR PRINTER SAMPLES

EPSON MATRIX PRINTERS

Prices Reduced

EPSON RX80T	100 cps	£220+VAT
EPSON RX80F/T	100 cps	£250+VAT
EPSON FX80	160 cps	£385+VAT
EPSON RX100	100 cps	£395+VAT
EPSON FX100	160 cps	£ Please call
EPSON LQ1500	200 cps	£ Please call

MICROLINE LOW COST PRINTERS

- UP to 25% faster thru-put than nearest rival.
- Near letter quality (92/93/84)
- Ideal printer for business systems.
- High Res Graphics (92/93/84)

Prices Reduced

Microline 80	80 cps	£195 + vat
Microline 82A	120 cps	£275 + vat
Microline 83A	120 cps	£450 + vat

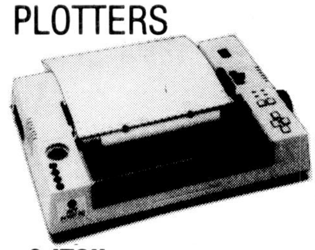
(M82A & M83A serial & parallel interfaces are standard)

Microline 84 200 cps £750 + vat
Sheet feeder for M84 £299
IBM version available

Microline 92 160 cps £415 + vat

Microline 93 160 cps £550 + VAT
The ideal alternative to EPSON FX100 – Faster thru-put and near letter quality. Recommended for IBM, SIRIUS, APRICOT.

PLOTTERS



C.ITOH

CX4800 – £595+VAT
4 COLOUR

CX6000 – £745+VAT
6 COLOUR

PIXY PLOTTER – £599+VAT

BROTHER TYPEWRITER/PRINTER EP44 £220 + VAT. CE60 £410 + VAT.

Micro General

DEALER/OEM ENQUIRIES WELCOME

■ ***Always** call for the best possible price* Access/Visa

(PCW 7) Unit 25, Horseshoe Park, PANGBOURNE, READING, RG8 7JW Tel: 07357 4466

LONDON COMPUTER CENTRE

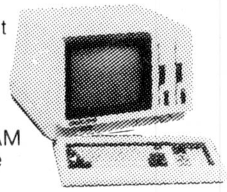
olivetti M24

Compatible & faster than IBM PC

2 Drive System 128K	**£1,939**
10Mb Hard Disk (XT)	**£3,899**

*Built-in Graphics & Colour
*Runs Flight Simulator, Lotus 1-2-3 on mono or colour
*7 IBM slots
*8 Mhz 8086 true 16 bit

NEC



16 bit 8086 128K RAM
2.4 Mb Disk storage
CP/M86 or MSDOS

Green Screen	**£1,985**
Colour Display	**£2,595**

LCC SPECIAL BUNDLE

NEC APC	RRP	**£1,985**
Dot Matrix Printer	RRP	**FREE**
Cables	RRP	**FREE**
	You pay	**£1,985**

Northstar Dimension
The IBM compatible multi-user system (up to 13 users)
15Mb hard disk and 2 user stations complete with VDU running IBM graphics **£5,375***
Each subsequent work station (8088 CPU 128K RAM) **£1,275**
*including 12 months on-site warranty.

CHAMELEON IBM Compatible £1995
with 9" Screen, 2 × 360K Drives
Colour and Mono inbuilt.
FREE Perfect Writer, Speller, File, Calc.
Super Calc 3, MSDOS GW basic Z80 CP/M
TMS Illustrator Comms. Package

LAP PORTABLES

NEC 8201 16K	**£475**
EPSON HX20 16K from	**£402**
TANDY 100 8K	**£433**

apricot xi

5/10Mb Hard Disk **£2,695/£2,995**
Standard Floppy Version **from £1,495**

sirius 1

1.2 Mb Disk storage	**£2,195**
2.4 Mb Disk storage	**£2,895**
10 Mb Disk storage	**£3,995**

DOT MATRIX PRINTERS

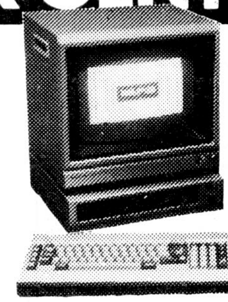
CANON 80 Col 160cps	**£319**
CANON 156 Col 160cps	**£399**
GEMINI 10X/15X 120cps	**£249/359**
EPSON FX80/FX100 160cps	**£437/£569**
RADIOSHACK (TOSHIBA) 2100	**£1,130**
BROTHER HR/15/25	**£445/£795**

DAISYWHEEL PRINTERS

FLOWRITER 1600	60cps	**£1,600**
TEC F10	40cps	**£1,050**
Tec F1500	25cps	**£450**
JUKI	18cps	**£449**

SHEET FEEDERS

BDT 2 Tray Auto	**£595**
BDT 3 Tray Auto	**£695**
BDT Single	**£375**
Juki Sheet Feeder	**£239**
Juki Tractor Feeder	**£99**
Tractors (Qume RICOH, Tec)	**£139**



SANYO

- IBM COMPATIBLE 16 bit
- runs most non-graphic software

8088 CPU. 128K RAM (expandable to 256K) MSDOS

550 1 Drive 160K	**£749**
*550/2 2 Drives 160K ea.	**£875**
555 2 Drives 160K ea.	**£900**
*550/2D. 2 Drives 360K ea.	**£999**
*555/2D. 2 Drives 360K ea.	**£1,295**
550/QD 2 Drives 720K ea	**£1295**
555/QD 2 Drives 720K ea	**£1550**

*LCC upgrade
Free Wordstar & Calcstar with 550
Free Wordstar, Calcstar, Mailmerge, Spellstar & Infostar with 555

Sanyo Monitor mono	**£125**
Sanyo Monitor colour	**£499**

HARD DISKS

Hard Disks for IBM PC Sirius QX10, NEC

10 Mb	**£1,545**
15 Mb	**£1,695**
20 Mb	**£1,995**
10 Mb Tape Streamer IBM PC	**£995**

PLOTTERS

Hewlett-Packard 74754A 6 Pen	**£1,401**
Roland DXy 800 A3, 8 Pen	**£ 520**

MODEMS/MONITORS

Buzz Box. Direct Connect Modem	**£70**
Sendata Accoustic Coupler	**£220**
Philips 12" Green. Hi Res	**£85**
TAXAN 12" RGB Hi Res	**£399**

ACCESSORIES

Floppy Disks	Printer Buffers
Daisywheels	Paper
Ribbons	Labels
Cables	Computer cleaning kits
Disk containers	Acoustic Hoods

SOFTWARE 8/16 Bit

The comprehensive range includes

WORDSTAR £235
SUPERCALC II/III £190/£275

WORD PROCESSING	£
Spellbinder	290
Peach Pack*	332
Mutimate	332
Spellstar	134
Maillist	50
Grammatik	85
FINANCIAL PLANNING	
Plannercalc	85
Multiplan	170
Lotus 1-2-3	357
D BASE CORNER	
FastBase	150
Autocode	195
Quickcode	205
Dgraph	190
Friday	185
Infostar	266
DMS	400
UTILITIES	
Sid £60, ZSid £76.	
Mac £133	

D BASE II £349
SPELLING CHECKER £80

LANGUAGES	£
MBasic	215
MBasic Compiler	235
C Compiler	330
Fortran 80/86	325
Cis Cobol/Forms2	399/105
Pascal MT +	240
Pascal MT + *SSP	350
ACCOUNTING	
Pegasus from	250
Peachtree from	325
Sage	375
Exact	750
Pulsar from	195
COMMUNICATIONS	
Bstam	130
Crosstalk	135
Moveit 80/86	90

*Incl. PeachSpell/Maillist
Please telephone for the LCC Software Catalogue

FORMATS: Superbrain, Televideo, Sirius, Sanyo, Osborne Northstar, 8" SD, DEC, Epson QX-10, IBM
ICL, H-P, XEROX, ALTOS, Apricot, NEC-APC & many more
All prices are exclusive of VAT

Looking for an easy-to-use cost effective File Handling System?

Thank god it's Friday! £185
by ASHTON·TATE

Friday will take care of your Files, Reports, Diary, Mailing and much more. It enables electronic files to be set up. Reports can be displayed and retrieved fast from all or part of a file. Friday is fast and versatile. It is designed for beginners.

Friday enables you to prepare custom reports to suit your requirements and presentation.
Friday enables you to sort and select any field.

Friday uses on screen prompts and help menus to guide you through the job you are doing.

DEMONSTRATIONS SALES-SERVICE SUPPORT

43 Grafton Way, London W1P 5LA (Opposite Maples)
Opening Hours: 10-7 Mon-Fri. 12-4 Sat.
01-387 4455 (4 lines) Telephone Answering Service After Office Hours
Telex: 8953742

VITAL INSURANCE NEWS FROM HALSEY & COMPANY

- **USERS** are provided with a low cost alternative to computer maintenance with free choice of repairer plus full "All Risks" cover and additional expenditure including data recovery costs. Ask for a 'DATACOVER' quotation.

- **DEALERS** consultants and software houses at last have an insurance scheme specially designed for them combining wide cover (especially away from the premises) with highly competitive premiums. Ask for a 'DEALERCOVER' quote.

- **MANUFACTURERS & MAINTAINERS** have computer breakdowns paid for by 'DATACOVER PLAN 5'

- **CONSULTANTS** and all those giving *any* advice are protected against claims for inadequate or faulty advice, errors and ommissions under our 'LEGALCOVER' professional indemnity scheme.

- **SOFTWARE WRITERS** and others obtain legal expenses cover including pursuit or defence of actions involving software copyright under our 'PROGRAMCOVER' scheme.

- **ALL COMPUTER PEOPLE** qualify for specialist covers for death, loss of income, pensions and our free financial planning services under our 'COMPUTERMAN' scheme.

Available exclusively through:—

HALSEY & COMPANY
7 Passage Road
Westbury-on-Trym
Bristol BS9 3HN
Avon
Telephone (0272) 503716

'The Insurance Brokers for Computer People'
Approved Agencies given

MBP COBOL

NOW AVAILABLE IN THE UK!

FOR IBM PC, NCR DM5, TI PC

Cobol Compiler

(NOT INTERPRETED)

- 5 to 7 times faster than other compilers
- Interactive screen handler
- Interactive debug facilities
- Extensive sort and chain facilities

ECS
EUROPEAN COMPUTER SERVICES INC

For further details please write or telephone
European Computer Services Inc
1 Charlbert Court
Charlbert Street
London NW8 7BX
Telephone 01-722 1283
Telex 881 3270

CUT OUT FOR FUTURE REFERENCE

TURN TO PAGE 124
FOR

SUMMER MADNESS SALE

LOWEST PRICE PRINTERS

FROM

SCI UK LTD.

OPEN 7 DAYS A WEEK

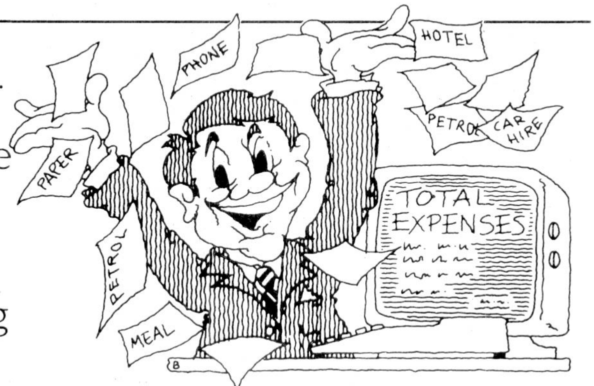
TURN TO PAGE 124

1. KEEP TRACK OF THE GOLF CLUB ACCOUNTS.
The GEC Dragon RMS program will record all the details, and prepare the accounts beautifully typed at the end of the year. (Or any other time.)

2. ACHIEVE INSTANT FINANCIAL STATUS.
Whether you're in business or not, the Dragon will give you an accurate picture of your assets (or liabilities) almost instantly.

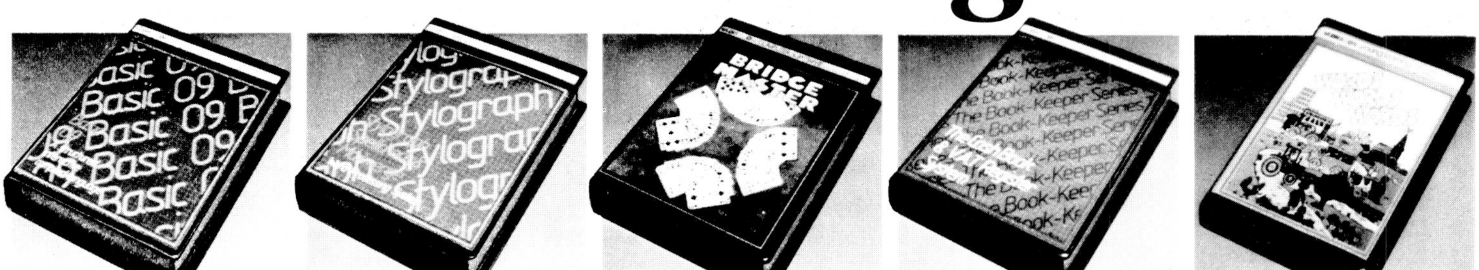
5. COST OUT JOBS.
Many small businesses are using the GEC Dragon to simplify and speed up their complete job-costing operations—and saving a fortune in the process.

6. INTEGRATE YOUR POLYNOMIALS.
GEC Dragon's UNIX-like software to the rescue again. If you can handle the maths, the GEC Dragon will take care of all the calculations.



8. TURN YOUR EXPENSES FROM FICTION INTO FACT.
Keep a day-by-day account of your business expenses and credit card transactions —with instant printout at any time.

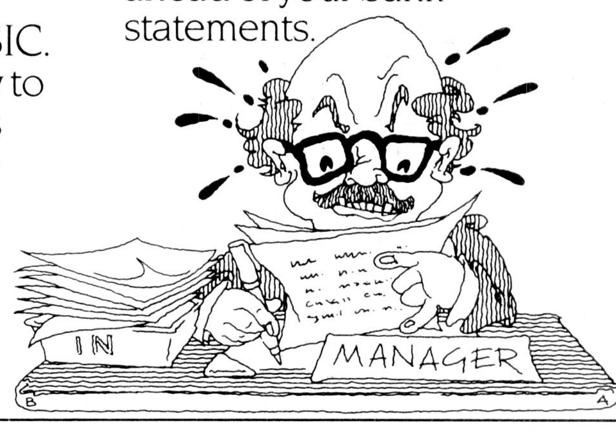
"What else would I do with a GEC Dragon 64?"



3. MAKE SURE THE CASH FLOWS IN. AS WELL AS OUT.
With the Sales and Purchase program soon to be available, you'll have complete control over your company's cash flow.

4. LEARN TO PROGRAM IN PASCAL, C, OR BASIC.
Although it's childsplay to use, the GEC Dragon is certainly not limited to games. In fact it has as much brain power as some computers that cost thousands.

7. SEND A SHIRTY LETTER TO THE BANK MANAGER FOR A CHANGE.
You should enjoy this. The Dragon is a big ally when it comes to personal finance. It'll keep you permanently one step ahead of your bank statements.



9. DESIGN A BRIDGE.
GEC Dragon's UNIX-like software (based on programs which were specifically designed for universities) will help you perform stress analysis, quantity surveying and many more complex functions.

WANTED

A CP/M BUSINESS MICRO THAT I CAN BUY FOR £650
THAT CAN BE EXPANDED INTO A COMPLETE BUSINESS SYSTEM
WITH MULTI-USER AND MULTI-TASKING POTENTIAL
ON WHICH I CAN ADD MORE MEMORY OR SECOND PROCESSOR WHEN I WANT
AND CHOOSE ANY SOFTWARE FROM THE HUGE CP/M LIBRARY WHEN I AM READY
BUT FROM A COMPANY WHICH GIVES ME FULL TRAINING AND SUPPORT
WITH SALES PEOPLE WHO TALK A LANGUAGE I CAN UNDERSTAND

FOUND
THE WATSON MICRO

THE WATSON MICRO OFFERS ALL THIS AND MORE

A STARTER UNIT FOR £650 WITH:
4 MHz Z80A with 64K RAM, huge expansion potential and CP/M compatability
Floppy disk controller, video controller, 16 option card slots, professional keyboard

A BASIC BUSINESS UNIT FOR £1250 WHICH INCLUDES
4MHz Z80A with 64K RAM and expansion to 10MHz 8086 and 832K RAM
620K dual disk drive system with expansion to 1240K system or 10MB hard disk
CP/M and MBASIC with discounted cost Wordstar-Mailmerge-Spellstar-Database package
12 inch high resolution green phosphor tilt and swivel monitor
Full professional keyboard with a range of special function keys
Serial printer port, serial communications port, parallel printer port
16 option card slots, cards include 64K or 192K RAM or realtime clock etc
A range of low cost printers to match
Twelve months' instant replacement warranty
Two complete days free training and consultancy service
Tailoring of any compatible accounting system to your needs

SUPERFAST BUSINESS UNIT FOR £1750
with 256K RAM, ramdisk, realtime clock with battery back-up
Turbodos multiuser operating system, fully CP/M compatible
£1,000 worth of free software including Wordstar, Mailmerge, Spellstar

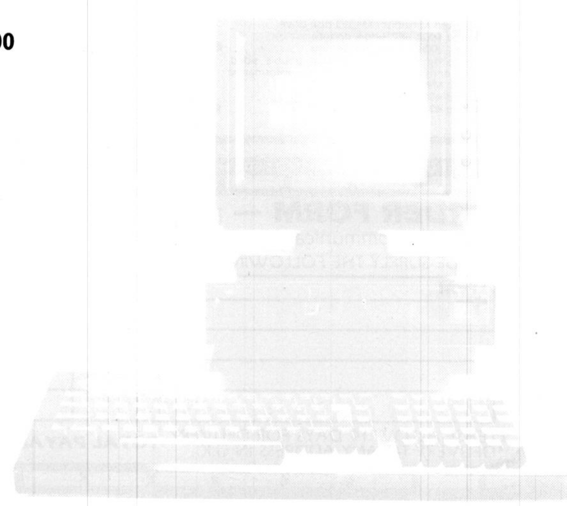
WORDPROCESSING SYSTEM INCLUDING LETTER QUALITY PRINTER FOR £1750

MULTI-TASKING BUSINESS SYSTEM
WITH 8086, 256K RAM, CONCURRENT CP/M AND FREE SOFTWARE FOR £1950

COMPLETE SYSTEM WITH 10MB WINCHESTER HARD DISK SYSTEM FOR £2400

MULTI-USER SYSTEM WITH 10MB HARD DISK
AND 5 INTELLIGENT USER TERMINALS FOR LESS THAN £9000

THE WATSON MICRO IS SO ADAPTABLE THAT IT IS
NOW ALSO AVAILABLE AS A COMBINED 3-IN-1 MICRO
WORDPROCESSOR AND ALSO AN AUTOMATIC ONLINE
REALTIME TELEX MACHINE INCLUDING PRINTER
FOR £2950



WATSON COMPUTERS AT MICRO ANSWERS
70 WILTON ROAD, LONDON SW1V 1DE
TELEPHONE US ON:
01-352 0343 or 01-352 5062

MACRO SAVINGS FOR MICRO USERS

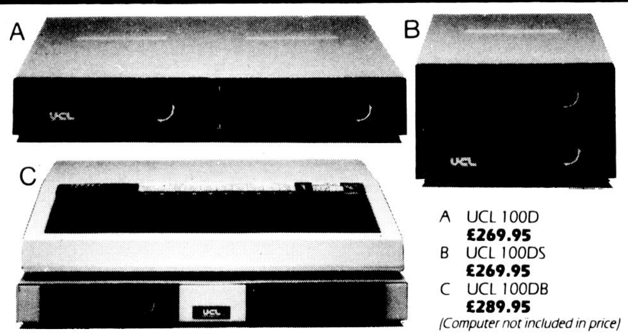
UNIVERSAL COMMUNICATIONS COMPANY · BRITAIN'S FASTEST GROWING COMPUTER PERIPHERALS HOUSE.

WE GUARANTEE THESE ARE THE LOWEST PRICES FOR DISK DRIVES OF THIS QUALITY ANYWHERE IN THE U.K.!

SINGLE DISK DRIVE UNITS
UCL 100C **£135.95**
DELIVERED TO YOUR DOOR*

£135·95!

PLUS A FULL RANGE OF SINGLE & DUAL DISK DRIVE SYSTEMS



A UCL 100D **£269.95**
B UCL 100DS **£269.95**
C UCL 100DB **£289.95**
(Computer not included in price)

ALL DISK DRIVE UNITS COME COMPLETE WITH:

* Ribbon cable to connect to BBC Micro
* Power cable to connect to BBC Micro
* Power cable to mains where PSU is fitted
* Manual and formatting disk

ALL METAL CASES

If you can find a Disk Drive of this quality, including all the extras we offer, at a lower price - then UCC will refund the difference on purchase of their unit and on receipt of proof of the lower offer.

DISK DRIVES AND DISKS.

ALL CASES COLOUR MATCHED TO BBC.
ABSOLUTELY NO EXTRAS - ALL READY TO PLUG IN AND RUN

UCL 100C	Cased, single sided, double density, 40 track 250K Unformatted Chinnon FDD 155 disk drive. Formatted 100K BBC single density. Formatted 200K BBC double density	**£135.95**
UCL 100D	Dual side by side case with two single sided, double density 40 track 250K unformatted Chinnon FDD 155 disk drives. Formatted 100K x 2 BBC single density. Formatted 200K x 2 BBC double density	**£269.95**
UCL 100DS	Dual stacker case with two single sided, double density 40 track 250K unformatted Chinnon FDD 155 disk drives. Formatted 100K x 2 BBC single density. Formatted 200K x 2 BBC double density	**£269.95**
UCL 100DB	BBC matching styled case with two single sided, double density 40 track 250K unformatted Chinnon FDD 155 disk drives. Formatted 100K x 2 BBC single density. Formatted 200K x 2 BBC double density	**£289.95**
UCL 200C	Cased, double sided, double density 40 track 500K unformatted TEAC 55B disk drive. Formatted 200K BBC single density. Formatted 400K BBC double density	**£175.95**
UCL 200D	Dual side by side case with two double sided, double density 40 track 500K unformatted TEAC 55B disk drives. Formatted 200K x 2 BBC single density. Formatted 400K x 2 BBC double density	**£339.95**
UCL 200DS	Dual stacker case with two double sided, double density 40 track 500K unformatted TEAC 55B disk drives. Formatted 200K x 2 BBC single density. Formatted 400K x 2 BBC double density	**£339.95**
UCL 200DB	BBC matching styled case with two double sided, double density 40 track 500K unformatted TEAC 55B disk drives. Formatted 200K x 2 BBC single density. Formatted 400K x 2 BBC double density	**£359.95**
UCL 400C	Cased double sided, double density 80 track 1mb unformatted Mitsubishi M4853 disk drive. Formatted 400K BBC single density. Formatted 800K BBC double density	**£199.95**
UCL 400D	Dual side by side case with two double sided, double density 80 track 1mb unformatted Mitsubishi M4853 disk drives. Formatted 400K x 2 BBC single density. Formatted 800K x 2 BBC double density	**£389.95**
UCL 400DS	Dual stacker case with two double sided, double density 80 track 1mb unformatted Mitsubishi M4853 disk drives. Formatted 400K x 2 BBC single density. Formatted 800K x 2 BBC double density	**£389.95**
UCL 400DB	BBC matching styled case with two double sided, double density 80 track 1mb unformatted Mitsubishi M4853 disk drives. Formatted 400K x 2 BBC single density. Formatted 800K x 2 BBC double density	**£412.95**
UCL 4080C	Cased double sided, double density 40/80 track 500K/1mb unformatted TEAC 55F disk drive	**£219.95**
UCL 4080D	Dual side by side case with two double sided, double density 40/80 track 500K/1mb unformatted TEAC 55F disk drives	**£419.95**
UCL 4080DS	Dual stacker case with two double sided, double density 40/80 track 500K/1mb unformatted TEAC 55F disk drives	**£419.95**
UCL 4080DB	BBC matching styled case with two double sided, double density 40/80 track 500K/1mb unformatted TEAC 55F disk drives	**£442.95**

CONTROL DATA FLOPPY DISKS

SS/DD 48 TPI Per Pack of 10	£16.40	SS/DD 96 TPI Per Pack of 10	£24.00
DS/DD 48 TPI Per Pack of 10	£20.50	DS/DD 96 TPI Per Pack of 10	£26.00

All Floppy Disks carry a minimum 5 year guarantee

For details of our full range of single sided 40/80 track switchable Disk Drive Unit or any combination of Disk Drive Units - please telephone.

NEW

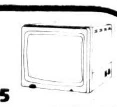
MICROWARE DOUBLE DENSITY DISK CONTROLLER FOR BBC MICRO

ONLY £99·95

* Supports single and double density.
* Supports 40 or 80 tracks.
* Acorn compatible, runs Basic, Form BCPL, View, Wordwise, Gemini, etc.
* Up to 128 files per side.
* Supports single and double sided discs.
* Firmware Format and Verify.
* Complete with 80 page Manual
* Simple to fit
* Compatible with sideways Ram
* Ability to set Page at &E00 to allow cassette programs to run.

UNIVERSAL COMMUNICATIONS COMPANY · BRITAIN'S FASTEST GROWING COMPUTER PERIPHERALS HOUSE.

MICROVITEC



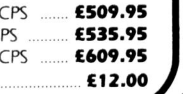
1431/MS4 14 inch std. res.	**£199.95**
1451/MS4 14 inch med. res.	**£299.95**
1441/MS4 14 inch Hi. res.	**£439.95**
2031/CS-5 20 inch std. res.	**£325.95**

MICROVITEK RGB/COMPOSITE VIDEO MONITORS NEW

* 1431/AP MS4 14inch PAL/TTL Monitor with audio facility	**£249.95**
* 2030/AP CS 20 inch PAL/TTL Monitor with audio facility	**£425.95**

PRINTERS

NEW



Daisystep 2000 Daisywheel Printer	**£299.95**
Tractor Feed	**£95.95**
Cut Sheet Feeder	**£225.95**
RS 232 Interface	**£85.95**

STAR DOT MATRIX PRINTERS

Gemini 10 x 80 Column 120 CPS	**£239.95**
Gemini 15 x 136 Column 120 CPS	**£349.95**
Delta 10 80 Column 160 CPS	**£379.95**
Delta 15 136 Column 160 CPS	**£509.95**
Radix 10 80 Column 200 CPS	**£535.95**
Radix 15 136 Column 200 CPS	**£609.95**
BBC Cable	**£12.00**

UNIVERSAL COMMUNICATIONS COMPANY
Unit 17/18,
Bowling Court Industrial Estate,
Bowling Back Lane,
Bradford BD4 8TF
CALLERS WELCOME
TEL: BRADFORD (0274) 390114

UCC

SALES POLICY: WE SELL THE HIGHEST QUALITY PRODUCTS AT THE LOWEST POSSIBLE PRICES.

UNIVERSAL COMMUNICATIONS COMPANY · BRITAIN'S FASTEST GROWING COMPUTER PERIPHERALS HOUSE.

BRITAIN'S FASTEST GROWING COMPUTER PERIPHERALS HOUSE.

SALES POLICY: WE SELL THE HIGHEST QUALITY PRODUCTS AT THE LOWEST POSSIBLE PRICES.

ORDER FORM — FILL IN THE ORDER FORM AND SEND IT WITH REMITTANCE TO:—

Universal Communications Company, FREEPOST, Unit 17/18, Bowling Court Industrial Estate, Bowling Back Lane, Bradford BD4 6BR.

PLEASE SUPPLY THE FOLLOWING

ITEM	QTY.	PRICE	TOTAL
		TOTAL PAYABLE	

PLEASE ALLOW 14 DAYS FOR DELIVERY
*DELIVERY TO ANY ADDRESS IN U.K.

NAME ....
ADDRESS ....
.... POSTCODE ....
TEL. NO. ....
I enclose a cheque/PO for a total of £ ....
made payable to U.C.C.
Signed ....

IMPORTANT - ALL UCC PRICES INCLUDE VAT, DELIVERY & PACKAGING NO EXTRAS

(Illustrations UCL 200 Series.)

WE WELCOME EDUCATIONAL AND LOCAL AUTHORITY ENQUIRIES.

THE EPSON PX-8

184K IN A BRIEFCASE

Meet the Epson PX-8. Up to 184K RAM, CP/M, bundled software, a whopping great 80-character, 8-line LCD Screen, runs off batteries anywhere you like, weighs around 4lbs and is as big as a box of chocs. The PX-8's standard 64K RAM is upped to an incredible 184K usable RAM by the optional clip-on RAM pack. That's the first of a whole range of peripherals like printers, a disc drive, an acoustic coupler and a bar-code — and they're portable too.

It goes without saying that the PX-8 runs straight off the mains too, and plugs easily into existing Epson mains-powered printers, the QX10 micro and most other desk-top micros as well. It is tremendously user-friendly and the bundled software it comes with is a specially-tailored version of tried and trusted industry favourites — Portable Wordstar, Portable Calc, Portable Scheduler, Portable Cardbox Plus as well as Microsoft Basic. And there's a whole range of utilities including communications and file transfer.

In short, the PX-8 is the next leap forward in truly portable computing.

HX-20 PORTABLE COMPUTER

HX-20 COMPUTER	£350
HX-20 MC	£75
HX-20 EU 16K RAM	£75
HX-20 ROM CARTRIDGE	£39
CORRESPONDENT	£30
M LIST	£30
ECALC	£30
DIY	£30
INTEXT	POA

EPSON QX10

QX 10 192K RAM. INCLUDING: PEACH TEXT; MAIL LIST; PEACHCALC; EPSON RX80 PRINTER; SPELLCHECKER £1999

SAGE ACCOUNTS	£375
TELECOMMUNICATIONS	£95
PAYROLL	£195
WORDSTAR	£295
SPELLSTAR	£145

EPSON PRINTERS

FX80	£339
RX80	£229
RX80FT	£259
FX100	£459
DX10	POA
RX100	POA
P40	POA
P80	POA

MAIL ORDER

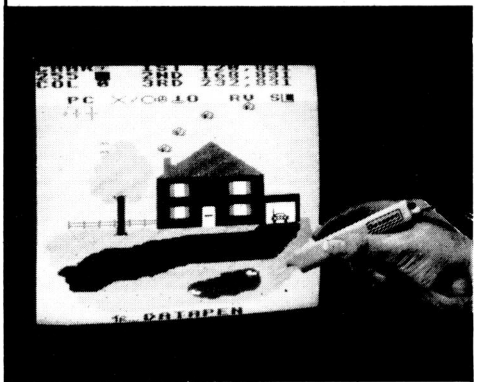
Please send orders with cheque to: TASHA. Add 15% VAT. Securicor: Add £6 per box. Prices are subject to change without prior notice.

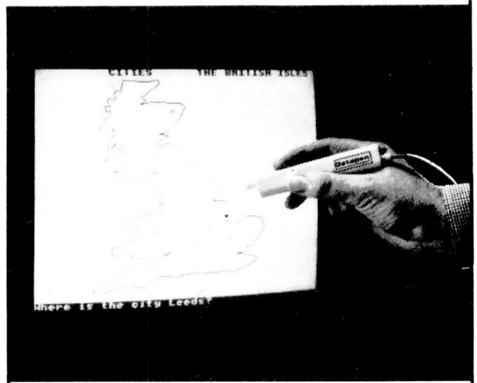
TASHA BUSINESS SYSTEMS
191 Kensington High Street
London W8
Tel: 01-938 1588 ext 33

BEST BUYS IN COMPUTERS FOR 1984

Tasha
Business Systems

Datapen BBC Lightpen Programs Datapen





BEEBPEN DRAWING PROGRAM
A comprehensive Mode 2 colour drawing program allowing plot commands, painting, circles, text, character defining, saving and loading to tape or disc, all to be selected and used with the lightpen.
PRICE £11.95 Introductory Offer £9.95

TELETEXT DISPLAY CREATOR/EDITOR
Allows the busy programmer to quickly create Mode 7 colour graphics and test screens for combination into his or her own programs. Movable on screen menu allows use of complete screen for graphics. Full instructions and a discussion on teletext features are provided. **PRICE £9.95 Introductory Offer £7.95**

BRITAIN
The first in a series of educational Geography and Geology programs. Britain comes complete with three sets of tests, and these may be very easily changed by adding DATA statements in the Basic program. Full instructions and grid map supplied.
PRICE £6.95 Introductory Offer £5.95

SUPERIOR PROGRAMS
- Tape storage of your work
- Good documentation
- User routines provided on tape and on printout

SUPERIOR PERFORMANCE
- Intensive to ambient lighting
- Responds to different colours
- Program accessible LED lamp readout
- Switch for program control

The Datapen Lightpen itself comes complete with handbook, software on tape including two drawing programs and a printed listing showing useful routines.

PRICE £25.00

Two drawing programs, SKETCH and SHAPE-CREATE are included with the lightpen and the programs shown above may be ordered additionally, or separately as required.

All prices above include VAT, postage and packing.

Please send your cheque/P.O. to:-

Dept. 4, Datapen Microtechnology Ltd., Kingsclere Road, Overton, Hants. RG25 3JB

ROSS & Co.

MEDIA

5¼ SS/SD DISKS............ *ONLY* **£12** for 10
5¼ SS/DD DISKS............ *ONLY* **£15** for 10
5¼ DS/DD DISKS............ *ONLY* **£18** for 10

PRINTERS

SHINWA CP-80............ **£199** including VAT
SEIKOSHA GP 100...... **£195** including VAT

MANY MANY MORE BEST BUYS!
RING **(0752) 671014**
(0837) 2041
FOR A QUOTATION ON ALL YOUR PERIPHERAL STATIONERY AND CONSUMABLES

SYSTEMS & SOFTWARE

ACT SIRIUS 1 WITH **FREE** INTRODUCTORY SOFTWARE

SAMPLE PRICES

LABELS FROM
£2·30 PER 1000 INC VAT

P & P
DISKS **95p**
PRINTERS **£4.95**
(Delivery Ex Stock)

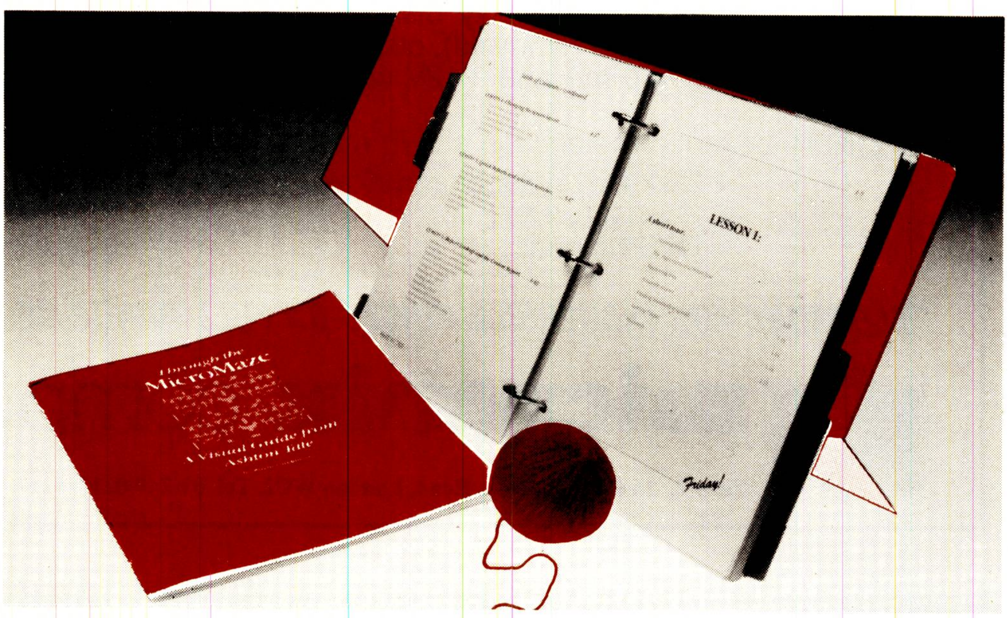
NAME ....
ADDRESS ....
TOWN..
COUNTY..
POSTCODE..
AMOUNT SENT £ : p

SEND COUPON & CHEQUES TO:

ROSS & CO
SHOBROOK
FOLLEY GATE
OKEHAMPTON
DEVON


PHILIPS
P2000
C

A way through the micromaze.



If all Theseus needed to find his way out of the maze was a ball of thread, isn't it time there was something just as simple to navigate the micromaze?

At last there is. It's a small, colourfully descriptive book called Through the MicroMaze. And it's part of an equally simple package to manage your time, your office – indeed your whole business. FRIDAY! will never lead you up a blind alley!.

FRIDAY! is genuinely the manager's best friend. Whatever your responsibility, you'll find FRIDAY! really easy going.

Personnel – holiday schedule – sickness records – salary review dates **Sales** – prospects – sales performance **Marketing** – advertising schedules – response monitoring – competitive information **Research** – new product data **Buying** – contract renewal dates – supplier schedules – supplier performance.

And because it's so good at managing files and looking after day to day tasks in the office, all your staff will soon find out how friendly FRIDAY! can be. FRIDAY! will take care of:

YOUR FILING... ● invoices ● inventories ● wages and salaries ● customers ● suppliers ● sales and commissions ● job costs ● personnel ● automatic record updates

YOUR PAPERWORK... ● selective reporting ● quick summaries ● formal reports ● ● calculation

YOUR MAIL... ● address selection ● standard letters ● mailing labels

AND EVEN YOUR TIME... ● diary ● contact lists ● telephone numbers ● priority action schedules

However small your business, there's always room for FRIDAY!. £190...

☐ buys you a complete system which saves you time, saves you money and saves you hassle.

☐ buys you a book that will tell you all you need to know about getting around today's micromaze.

☐ buys you FRIDAY!'s award-winning manual for immediate understanding and benefit.

☐ buys you security. FRIDAY! is backed by extensive technical and educational support from the world leader in micro database systems.

☐ buys you a future. Because FRIDAY! can fit in with other popular business software like WORDSTAR, 1-2-3 and, of course, our own dBASE II.

So why do it the hard way, when you can take the easy way out? If ever there was a complete package for the beginner, it's...

Friday!™

'Good value at £190'
Deenagh Brook,
MicroDecision
February 1984

'RITA Award 1984'
Best User Training Manual

ASHTON·TATE

Supported by: Ashton-Tate (UK) Limited, Cofferidge Close, Stony Stratford, MK11 1BY.
CALL: 0908 568866

THE GREAT SUMMER SALE

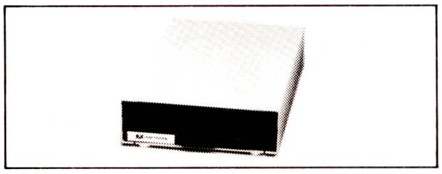
100K (ACORN DFS) /200K (DOUBLE DENSITY DFS) BBC DRIVE

ONLY £110+VAT=£126.50

Carriage £8 extra

FULL YEAR WARRANTY

ACCESS WELCOME



* EDUCATIONAL ORDERS WELCOME!
* DEALER AND EXPORT ENQUIRIES INVITED

Slimline, half height, top quality disk drive from CHINON, Japan featuring full microprocessor control (no LSI gimmick!), quietest operation and lowest power requirement in the industry (+5V @ 450 mA and +12V @ 190 mA).

Beautifully boxed in metal case and in matching BBC colour and supplied complete with:

★ Disk Drive Cable and Power Lead
★ Formatter Disk
★ DFS Manual

TELEPHONE FOR INCREDIBLE PRICES ON FULL RANGE OF BBC DRIVES!

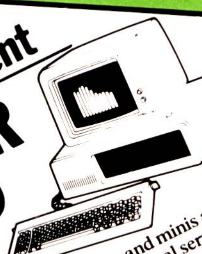
micronix computers Ltd

Suite 2, 26 Charing Cross Road, London WC2. Tel. 01-240 0213/0217. Telex. 295173 VILORD G

HAMILTON

IBM PC for rent

BY POPULAR DEMAND



There's no more popular PC than the IBM: its reliability and future support are undisputed.

And there's none more popular than Hamilton, the company with the widest range of micros and minis and a proven reputation for ex-stock delivery, on-site warranty and national service.

By popular demand, Hamilton gives companies the chance to rent or buy the IBM PC plus peripherals and data communications packages.

It takes the extensive resources of Hamilton to satisfy such a popular demand. Phone us first.

Capability, availability and above all *flexibility*

RED ALERT *Hotlines*

London : 01 961 6777
Birmingham : 021 236 3561
Manchester : 061 848 8338
Aberdeen : 0224 770816

Rent or Buy? We'll tell you why.

Not sure whether to rent or buy?
Then send for our FREE guide.

Name
Job Title
Company
Address

Telephone

Complete and return this coupon to:
Hamilton Rentals Ltd, Hamilton House,
North Circular Rd, London NW10 7UB.

Hamilton rents or sells virtually every piece of computer hardware or software your business needs. With ex-stock delivery on most items and on-site warranty service on all.

Phone us first for: Minis · Desktops · PCs · Word Processors · Graphics Terminals · VDUs · Plotters · Printers · Modems · Multiplexers · Microprocessor Development Systems · Disk Drives · Tape Drives · Software

MEGABYTE BARGAIN. A FULLY FITTED DISC SYSTEM FOR £300.

Opus have an unbeatable offer for anyone who is thinking of upgrading their BBC Micro.

A one megabyte disc drive (unformatted) double sided 80/40 track hardware switchable, and a double density disc interface at only £299.95.

The Opus disc interface is fully Acorn compatible and therefore effectively doubles the capacity of your drive.

This bargain also includes VAT and a year's guarantee. But hurry, the offer only lasts until Saturday 21st July.

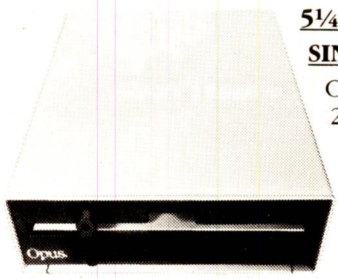
To take advantage of this unique offer, contact us on 01-701 8668.

We also have an extensive range of other disc drives and floppy discs at bargain prices, which can be ordered by posting the coupon below or calling at our showroom.

DOUBLE DENSITY DISC INTERFACE.

The ultimate Acorn compatible disc interface for your BBC micro.

- Utilities on ROM including: Format and verify, tape to disc transfer, automatic 40/80 track selection, automatic density selection, unique mass copy routine. Powerful machine code operating system giving up to 248 files, 80% faster than single density. Easy to install. Free user manual supplied **£129.95.**



5¼" JAPANESE DISC DRIVES.

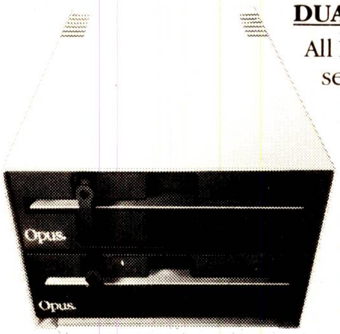
SINGLE DRIVE.

Opus 5401 Single Sided 40 Track – 250K. Unformatted. Formatted: 100K. Single Density, 200K. Double Density **£159.95.**

Opus 5402 Double Sided 40 Track – 500K. Unformatted. Formatted: 200K. Single Density, 400K. Double Density **£199.95.**

Opus 5802 Double Sided 80/40 Track. Hardware Switchable 1 Megabyte. Unformatted. Formatted: 400K. Single Density, 800K. Double Density **£249.95.**

- ½ Height • Includes case, leads and utilities disc.



DUAL DRIVES.

All Dual Drives are metal cased with separate power supply.

Opus Dual 5401D Single Sided 40 Track 200K/400K. on line **£339.95.**

Opus Dual 5402D Double Sided 40 Track 400K/800K. on line **£429.95.**

Opus Dual 5802D Double Sided Hardware Switchable 80 Track 800K/1.6 Megabyte on line **£499.95.**

FLOPPY DISCS.

3" Cartridges **£5.75** each or **£25.95** for 5.

5¼" Discs – with full 5 year warranty + free plastic library case.

S/SS/D **£17.95** for 10
S/SD/D **£19.95** for 10
D/SD/D **£21.95** for 10
S/S 80 Track **£25.95** for 10
D/S 80 Track **£27.95** for 10

OPUS 3" MICRODRIVE.

Double Sided 40 Track Drive ½ Megabyte. Unformatted.

- Twice the capacity on line of other available drives
- 200K. Single Density – 400K. Double Density
- Ex-Stock delivery
- 3ms access time
- Lowest power consumption – direct drive
- Includes case, leads and utilities disc
- Totally compatible with 5¼" drives

Single Drive **£229.95.** Dual Drive **£459.95.**

GENEROUS EDUCATION AND DEALER DISCOUNTS GIVEN. ALL ITEMS ARE GUARANTEED FOR TWELVE MONTHS AND ARE SUITABLE FOR USE WITH BBC MICRO.

OPUS SUPPLIES LTD.

158 Camberwell Road, London, SE5 0EE.
Opening hours: 9.00 - 6.00 Monday - Friday, 9.00 - 1.30p.m. Saturday,
01-701 8668
01-703 6155

OPUS PRODUCTS ARE AVAILABLE FROM W. H. SMITH, SPECTRUM, JOHN MENZIES, ALLDERS AND OTHER GOOD COMPUTER STORES NATIONWIDE.

To: Opus Supplies Ltd., 158 Camberwell Road, London SE5 0EE. Please rush me the following: **(ALL PRICES INCLUDE VAT & CARRIAGE.)**

Quantity	Description	Price
	TOTAL	

I enclose a cheque for £______
Or please debit my credit card account with the amount of £______
My Access/Barclaycard (please tick) No. is ______

Name______

Address______

Telephone______

PW17

Opus.
Opus Supplies Ltd.

SUPER VALUE

Fantastic savings on a wide range of printers, monitors and accessories from Teleprinter Equipment, one of the UK's largest distributors of computer peripherals. All fully supported by engineering services nationwide.

BMC 12" Monitors (Green)

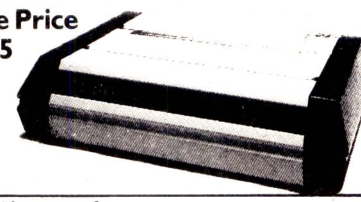
The original Apple Monitor renowned for long life and reliability

	RRP	Sale Price
24 x 80 Character Display		
High resolution 18 MHz bandwidth	£109	£95
Medium resolution 15 MHz bandwidth	£89	£69
BMC Swiveller Monitor Stand	£18	£15

GE 3014 PC Printer

Triple Mode: Draft, Memo and Excellent Letter Quality up to 160 cps
18 x 9 Matrix
RS232 + Parallel Interfaces

RRP £1068 **Sale Price** £995

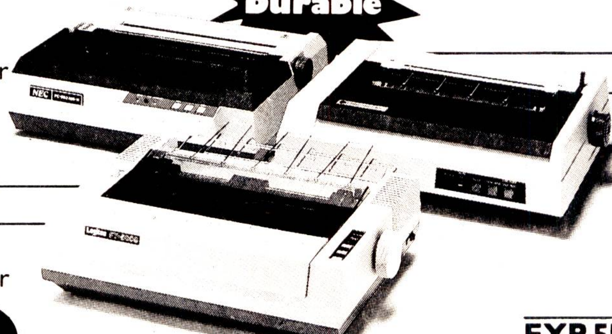


NEC PC-8023 BEN Printer

120 cps + Graphics
Pica and Elite Typestyles
Friction Feed + Adjustable Tractor

RRP £395 **Sale Price** £329

Fast and Durable



Microprism

110 cps + Near Letter Quality
84 x 84 dpi Graphics
Text Justification and Proportional Spacing

RRP £399 **Sale Price** £359

NLQ Printing

Logitek FT 5000 Printer

100 cps + Graphics
Friction Feed + Adjustable Tractor
Pica and Elite Typestyles

RRP £299 **Sale Price** £249

BEST BUY

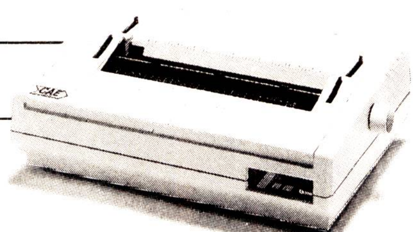
EXP 550 16 cps Daisywheel Printer

RRP £675 **Sale Price** £450

Qume Sprint II: World's Most Reliable Daisy

40 cps + Choice of RS232, Centronics, IEEE-488 and IBM PC Interchangeable Interfaces

RRP £1577 **Sale Price** £1495*



Qume Letter Pro 20 Printer

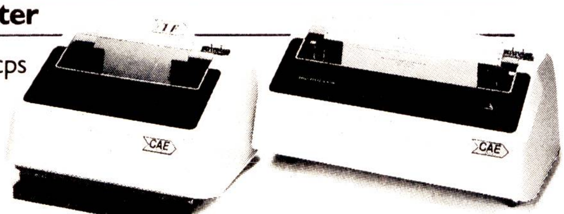
20 cps Daisy + Wordstar Compatible
10, 12, 15 Pitch + Proportional Spacing

RRP £744 **Sale Price** £699*

Prism 80 Column Printer

Draft or WP Quality + 200 cps
24 x 8 Staggered Matrix
250 Sheet Hopper Option

RRP £1054 **Sale Price** £843*



Prism 132 Column Colour Printer

Produces 144 Colour Shades
High Resolution 84 x 84 dpi Graphics
Lotus 1,2,3 Compatible

RRP £1584 **Sale Price** £1267*

Gallid Universal Printer Stand

RRP £85 **Sale Price** £70

Paper Bargains

2000 Sheets, 11" x 14½" Listing Paper **£18.10**
2000 Sheets, 11" x 9½" Listing Paper **£15.62**

Please add £10.00 for Packing and Delivery + 15% VAT. Rental from £15.00 per month for printers. Please call for full details.

DEALER ENQUIRIES WELCOME

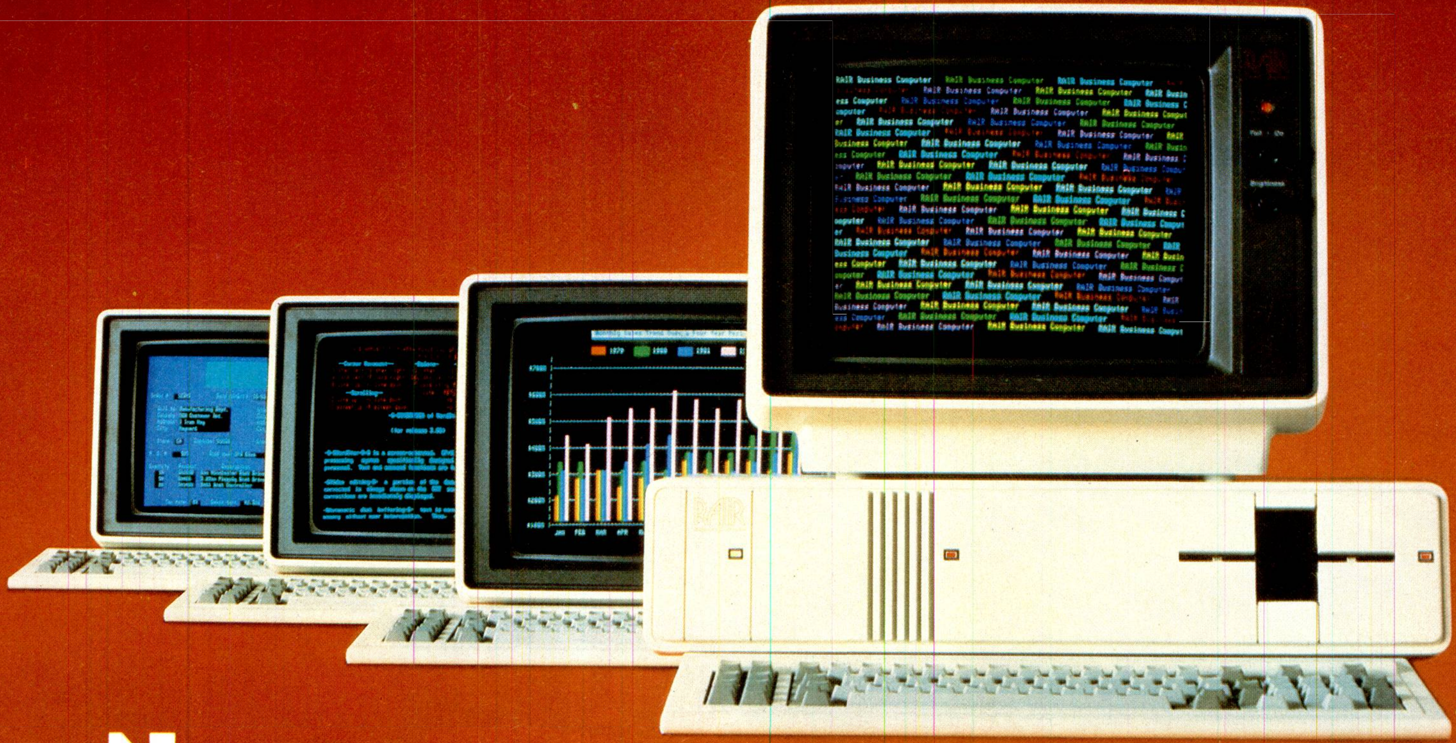
*Ex-Demonstration Stock.

Prices correct at time of going to press and may be subject to change without notice.

CAE GROUP

Teleprinter Equipment Ltd.
64-82 Akeman Street, Tring, Herts. HP23 6AJ. Telephone: Tring (0442 82) 4011/5551
Telex: 82362 BATECO G Cables: RAHNO TRING.

Now There's a Choice



The New RAIR Business Computers

Now there's a choice of RAIR Business Computers, from an entry level floppy disk system, through a high-capacity hard disk system, to our established high-performance multi-user system, all fully compatible and upgradeable.

Our new RAIR Business Computers incorporate a host of advanced features, including new high speed dual 16-bit and 8-bit processors for high performance software compatibility, colour displays for increased legibility, and multiple printers for user convenience. And our new software catalogue offers the best in business packages, including the latest Peachtree Business Management System, dBase II database manager, WordStar Professional word processor, SuperCalc II spreadsheet, and many more, all implemented for full 16-bit multi-user operation in colour.

So when you're choosing a new computer for your business, the choice is obvious – a new RAIR Business Computer.

For full details of the new RAIR Business Computers phone Teledata on 01-200 0200, or write to RAIR Limited, 6-9 Upper St Martins Lane, London WC2H 9PS.

RAIR

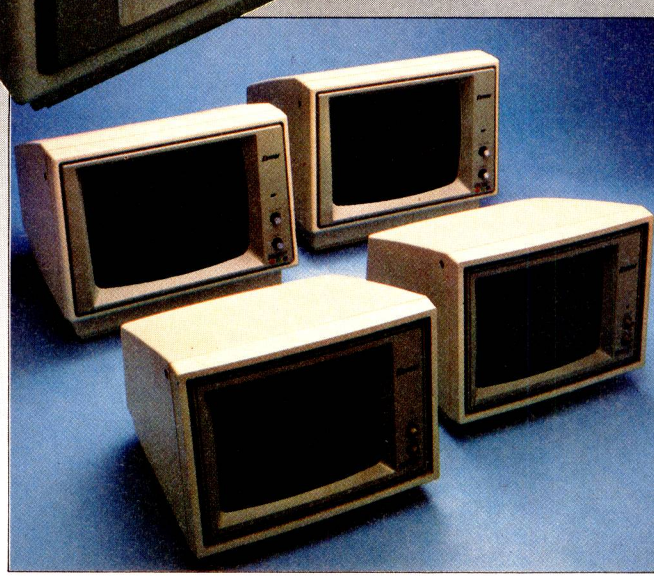
Peachtree is a trademark of M.S.A.
dBase is a trademark of Ashton Tate
WordStar is a trademark of Micropro
Supercalc is a trademark of Sorcim

Dyneer monitors... the perfect definition

THE DYNEER 14CMI Colour Monitor, pictured above, offers full IBM PC compatibility with 16 vivid colours.

Add to this the special dark glass, high-contrast CRT. This gives the user a crisp alpha-numeric display even in 80-column mode, whilst retaining true colour quality and balance.

Full IBM PC compatibility is also a major feature of the 12MHI, a 12 inch monochrome monitor featuring an anti-glare, P31, dark glass, chemically etched CRT. This high quality display incorporates high resolution – 900 lines minimum horizontal – with an unbeatable video amplifier response.



Two more monitors complete the Dyneer Family – the 14CHI is a Texas Instruments PC compatible Colour Monitor incorporating many features from the 14CMI, but offering even higher resolution and greater band-width.

The 12MHC is a Monochrome Monitor designed for composite video input requirements, but having exactly the same video attributes as the 12MHI.

And whether it's colour or mono, every Dyneer Monitor is built to the highest engineering standards and features the Dyneer Hallmarks – Quality, Reliability, and Unbeatable Price/Performance.

Ring us, and we'll tell you how.

X-DATA

THE NAME BEHIND
THE PRODUCTS IN FRONT

X-DATA LIMITED, 750 DEAL AVENUE, SLOUGH TRADING ESTATE, SLOUGH, BERKS SL1 4SH. TEL: SLOUGH (0753) 72331

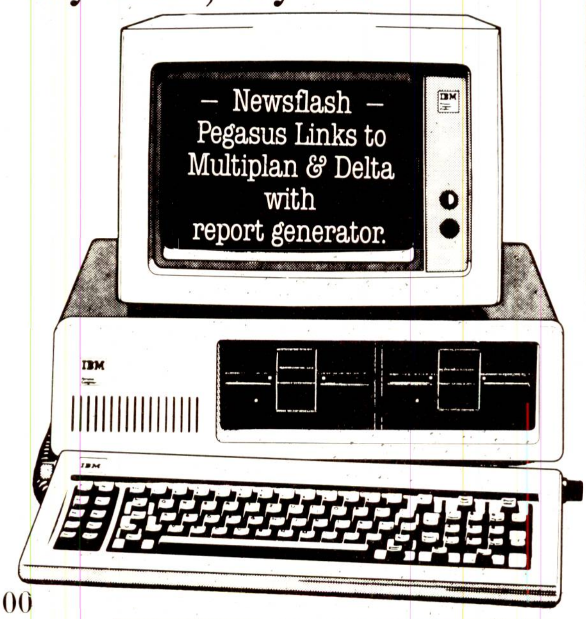
a Dyneer company

Microware announces a new concept in IBM sales: The immediately available PC.

If you've wasted a lot of time lately ringing IBM dealers only to find they cannot give you a delivery date, try us!

We will:

- Provide the widest range of software support.
- Offer comprehensive maintenance contracts.
- Take pride in our unparalleled after-sales service.
- Analyse and identify your requirements.
- Advise on your system needs.
- Supply and install your equipment.



SOFTWARE

MULTI-USER PEGASUS £295.00
Sales Ledger
Purchase Ledger
Nominal Ledger
Invoicing
Order Processing
Stock Control
Payroll
Job Costing

- Auditman – £1500.00
- Minuteman – £750.00

OPEN ACCESS – LOTUS EATER

- Only £475.00
- Database
- Spreadsheet
- 3-D Graphics
- Word Processor
- Appointments Diary
- Communications

LOTUS 123 – £375.00

- Database
- Spreadsheet
- Graphics

VARIOUS SELECTION

- PC Tutor 2.0 – £41.00
- CBasic – £140.00
- Pascal/MT+ £420.00
- Microsoft 'C' £384.00
- Chess – £61.00
- Norton Utilities – £56.00
- Backgammon – £35.00
- Electronic Disk – £50.00
- Copy II pc – £29.00

DATABASE PACKAGES

- dBASE II – £375.00
- DMS – £195.00
- Delta – £495.00
- Everyman – £475.00
- Knowledge Man – £350.00

WORD PROCESSORS

- WordStar – £245.00
- Microsoft Word/Mouse – £340.00
- Multimate – £340.00
- Wordcraft – £340.00
- Word Perfect – £425.00
- Send telexes from IBM PC – £1750.00

APPLE LINK

- Quadlink turns PC into Apple – £495.00

ARABIC IBM PC

- Conversion to Arabic – £590.00
- Arab Word Processor – £595.00

PRINTERS FROM £250.00

- Epson FX-80/FX-100/LQ1500
- Brother HR15/HR25
- NEC Spinwriter
- Sheet Feeders Available
- Typeface Catalogue Available
- Acoustic Hoods from £295.00

THE PROFESSIONALS

- Full training provided
- Free 12 months warranty
- Leasing deals arranged
- Highly competitive quotations
- Long and short term rentals

HARDWARE

BASIC SYSTEM

- IBM Personal Computer 64K RAM, Single sided Disk Drive Keyboard, Screen – £1567.00
- IBM Personal Computer 128K RAM, Twin 360K Drives Keyboard, Screen – £2087.00

BUSINESS SYSTEM

- IBM Personal Computer 256K RAM, Twin 360K Drives, Keyboard, Screen – £2299.00

HARD DISK SYSTEM

- IBM Personal Computer 128K RAM, 10Mbyte Hard Disk, Single 360K Floppy Drive Keyboard, Screen – £4078.00

HERCULES GRAPHICS CARD

- Additional Cost only £185.00

COLOUR SYSTEMS

- Additional Cost only £405.00

IBM
Personal Computer
IBM Authorised Dealer

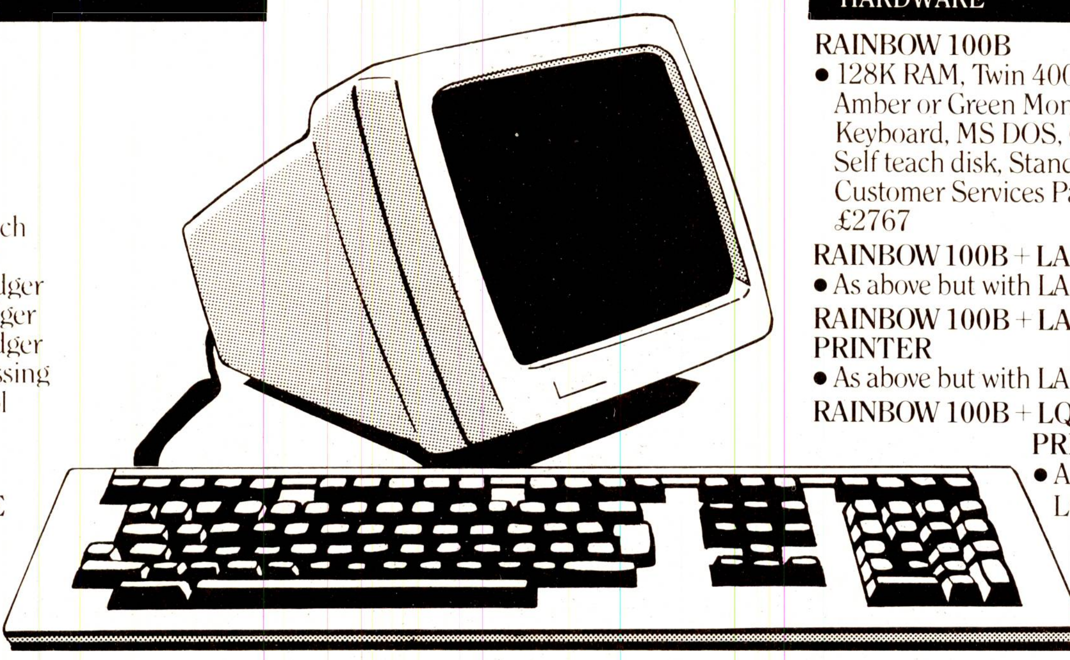
MICROWARE
BUSINESS SYSTEMS
637 Holloway Road London N19 5SS 01-263 1124 Telex 297598
14 Charles Street Hanley Stoke-on-Trent 269 883

Look over the Rainbow with Microware.

We offer you:

- Free 12 months on-site warranty.
- 4-hour on-site response at modest cost.
- Computer-based instructions.
- Free Digital training vouchers.
- Generous trade-in allowances.

Compare our prices



SOFTWARE

LOTUS 123
- only £375
- Database
- Spreadsheet
- Graphics

PEGASUS
- only £295 each
- Sales Ledger
- Purchase Ledger
- Nominal Ledger
- Invoicing Ledger
- Order Processing
- Stock Control
- Payroll
- Job Costing

INCOMPLETE RECORDS
- Ideal for Accountants
- Auditman – £1500
- Minuteman – £750

DEC GP
- Practice and Patient Records
- Health Service information to FPC
- Reduces Clerical and Professional Workloads
- Produces repeat prescriptions
- Analysis of practice data
- Secure against unauthorised access
- Totally Integrated System

VARIOUS SELECTION
- Multiplan
- TK! Solver
- Select Wordprocessor
- WordStar/Mailmerge
- Wordcraft
- dBASE II

THE PROFESSIONALS
- Full training provided
- Leasing deals arranged
- Long or short term rentals
- Highly competitive quotations
- Book your demonstration now!

HARDWARE

RAINBOW 100B
- 128K RAM, Twin 400K Drives Amber or Green Monitor Keyboard, MS DOS, CPM 80/86 Self teach disk, Stand and Customer Services Package – £2767

RAINBOW 100B + LA50 PRINTER
- As above but with LA50 – £3276

RAINBOW 100B + LA100 PRINTER
- As above but with LA100 – £4017

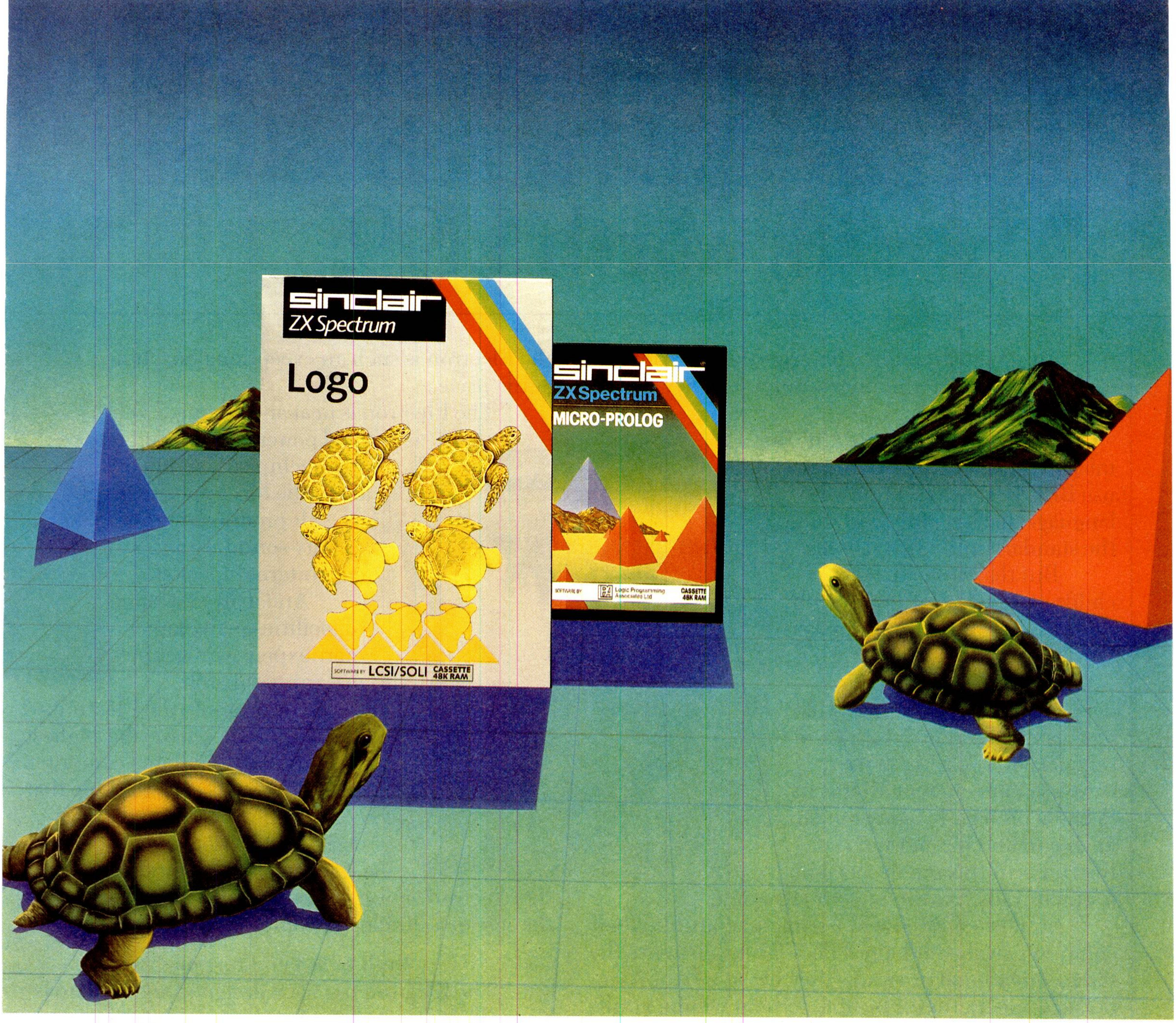
RAINBOW 100B + LQPO2 PRINTER
- As above but with LQPO2 – £4755

RAINBOW 100 + HARD DISK
- 128K RAM, Twin 400K Drives 10 Mbyte Hard Disk, Choice of Screens Keyboard, CPM 80/86, MS DOS, Self teach disk, stand and Customer Services Package – £4200

COLOUR SYSTEMS AVAILABLE
- Additional cost only £820

AUTHORISED digital PERSONAL COMPUTER DEALER

MICROWARE
BUSINESS SYSTEMS
637 HOLLOWAY ROAD, LONDON N19 5SS
TELEPHONE 01-263 1124 TELEX 297598



They're here! Two of the world's most sophisticated, imaginative languages.

LOGO and micro-PROLOG.

Now they're both available for the 48K Spectrum. So you can sample the programs thousands of computer owners can only talk about!

LOGO and micro-PROLOG are exciting, new-generation languages. They let you create descriptive, imaginative and powerful programs.

And – for such sophisticated languages – they're available at astonishingly low prices: £24.95 for micro-PROLOG and £39.95 for LOGO!

LOGO is a powerful programming language based on logic.

It's very easy to learn, so it's proved highly successful in schools.

LOGO puts you in command of a graphic 'turtle' (a moving, on-screen cursor). Each program instruction you make has a direct effect on the turtle. You can change its position, alter the direction it points in, and then use it to create complex shapes, images or designs.

With LOGO, you've the means to develop very imaginative ideas – and see the results immediately!

The Sinclair version of LOGO comes with two comprehensive manuals. It features turtle graphics, colour and sound, and has full list processing capabilities. It's also Microdrive-compatible, and can control a mechanical turtle or robot.

micro-PROLOG lets you explore powerful aspects of artificial intelligence.

It's a fifth generation language, specially adapted from PROLOG – the language chosen by the Japanese for the next generation of artificial intelligence machines.

Using micro-PROLOG, you develop a dialogue with your computer. First, it allows you to construct a database of relationships using simple English phrases. And then, you can ask the computer questions relating to the database.

Your micro-PROLOG package includes a front-end program called SIMPLE (for newcomers to the language), plus a User Manual and 300-page Primer. For more advanced users, a micro-PROLOG Reference Manual is available separately at £9.95.

Without doubt, LOGO and micro-PROLOG set new standards for future computer languages. You'll find them in major stores and all good computer shops – today!

Sinclair Research Ltd, Camberley (0276) 685311.

sinclair

The new Electron from Acorn. Ask any child at school why it's worth £199.

Most British children have one thing in common with the new Electron microcomputer: they speak the same language.

You see, the Electron is the first micro remotely in this price range to use BBC Basic, the computer language that is rapidly becoming the standard in British schools.

But that's not all. Most children will feel at home with the Electron as soon as they lay hands on it.

This is because it has developed out of the Micro that has been chosen by over 80% of schools participating in the Government's current Micros In Schools project. It has a similar keyboard and has most of the functions of this much acclaimed (but naturally, more expensive) machine.

So now children will be able to continue their computer studies at home. They'll be able to use the same educational programs they use at school. And, if asked nicely, they'll be able to help willing adults take their first steps into computing.

All this for only £199.

A micro technology break-through.

And now a few reasons for adults why the Electron is such an exceptional machine at the price.

The Electron is neat and compact. Yet it is fast and powerful. (Full details, for the technically minded, are in the box opposite.)

It produces high quality sound using its own internal speaker.

And it offers a range of facilities many larger more expensive machines just cannot match.

For example the Electron's colour graphics have the highest resolution of any home computer.

This is because the chip that controls the graphics, specially designed by Acorn, is one of the most advanced of its kind. As a result, the Electron delivers twice as many characters across the screen as its closest competitor.

Built to last and to grow.

The Electron has been designed and built to be a permanent part of the family, year in year out.

Particular care has been paid to the keyboard. It is electric typewriter style: robustly constructed with a good, solid 'feel.' It has a space bar, and single entry keys for key commands.

In other words it's comfortable and easy to use, avoiding the need for the manual gymnastics sometimes associated with calculator style keyboards.

And it will grow with you via expansion modules, that Acorn are developing, to take peripheral additions such as printers and disc drives. So as your knowledge, interest and ambitions develop, the Electron can develop with you.

Additionally, to give you all the support you'll need to generate your own applications software, we've established a phone-in service attended by specialists to give advice, encouragement and practical help.

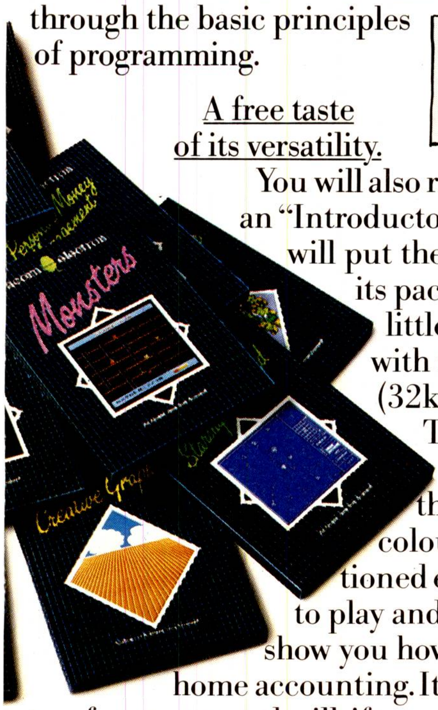
A gentle teacher.

The Electron plugs straight into virtually any TV set and cassette player so you will be

ready to go as soon as you get it home.

It comes not only with a comprehensive user guide, which describes the machine and its functions, but also with a book that takes you step by step through the basic principles of programming.

EXPERTS LIKE 'WHAT MICRO?' AND ME RATE THE ELECTRON HIGHER THAN ANY OF THE COMPETITION.



A free taste of its versatility.

You will also receive an "Introductory" cassette which will put the Electron through its paces showing you a little of what it can do with its 64k of memory (32k ROM, 32k RAM).

The cassette will give you a taste of those exceptional colour graphics we mentioned earlier; of its ability to play and notate music, and show you how it might help in home accounting. It will challenge you to a few games and will, if you ask it, do your whole family's biorhythms in a matter of seconds.

You will in short, through the 15 separate programs it contains, get a glimpse of the Electron's potential. But only a glimpse, for that potential is as limitless as your own interest and imagination.

A widening range of software.

To help you realise some of that potential, Electron software already ranges from "Personal Money Management" through "Starship Command" to "Creative Graphics" (which, incidentally, includes some spectacular three-dimensional rotating shapes). Naturally, with its strong educational links, educational software will be extremely

important for the Electron and even now O and A Level revision papers are being processed for Electron users.

How to get your Electron.

The Acorn Electron can be found at local Acorn dealers and major high street stores. However, if you would like to order one with your credit card, or if you would like the address of your nearest supplier, just phone 01-200 0200.

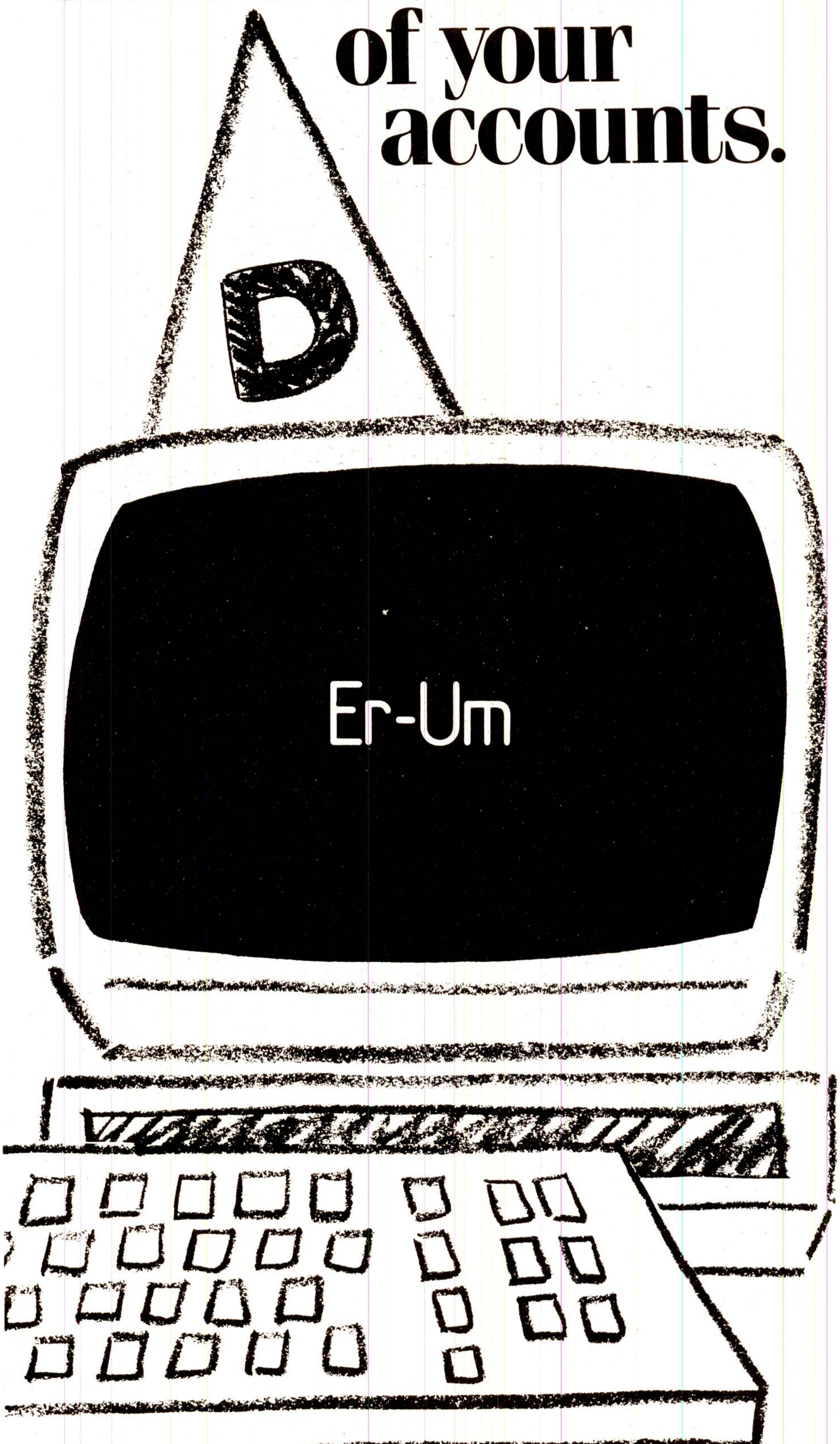
Technical Specifications

Hardware.
2MHz 6502.
32K ROM 32K RAM (64K total).
High resolution graphics 640 x 256 max.
Seven display modes.
8 colours and 8 flashing colours.
1200 baud CUTS tape interface with motor control.
Expansion bus for add-on interface modules.
Internal loudspeaker.
PAL UHF output to colour or black and white domestic TV.
RGB output for colour monitor.
56 key full travel QWERTY keyboard with spacebar.

Software.
BBC BASIC.
Extensions include interger, floating point and string variables, multi dimensional arrays: IF...THEN...ELSE, REPEAT...UNTIL, procedures with local variables.
Operating system allows plot, draw and fill commands.
Event timing.
Built-in assembler.
6502 assembly language can be mixed with BASIC.

The Acorn Electron.

Without the right program your computer could take a dim view of your accounts.



If your brand new, super-intelligent, electronic brain appears decidedly thick, it's probably not to blame. A computer is just a box of circuits. It's the program that makes it a box of tricks. Some programs are so inadequate they would make any computer look moronic. Others are far too complicated for the needs of the user and become uncontrollable monsters.

You'll be glad to know that Sage keep things simple, but effective. Our fully-integrated, one-diskette programs are easy-to-learn and use, yet cover every accounting function. From invoicing to final accounts, it's all there!

Sage is available on most CP/M, MS-DOS and PC-DOS computers and has so far been implemented on over 40 machines including Apple, Apricot, Epson, IBM-PC, Philips, Sirius and Zenith. What's more you can choose the program to suit your needs from four great-value options.

- SAGE ACCOUNTS £375
- SAGE PLUS £525
- SAGE EXECUTIVE £695
- PAYROLL £195

Just return the coupon below and we'll make sure your computer doesn't end up standing in the corner.

PCW4

☐ Please send me your explanatory brochure.

☐ Please arrange for me to have a demonstration.

I do not yet own a computer.
I have a ....computer.
*Delete as appropriate.

Name ....

Position ....

Company ....

Address ....

....

....

Tel: ....

SAGE
Business Software

SAGESOFT LIMITED, NEI HOUSE, REGENT CENTRE, NEWCASTLE UPON TYNE NE3 3DS.
Telephone 091 284 7077 Telex 53623 SAGESL G.

Alphacom

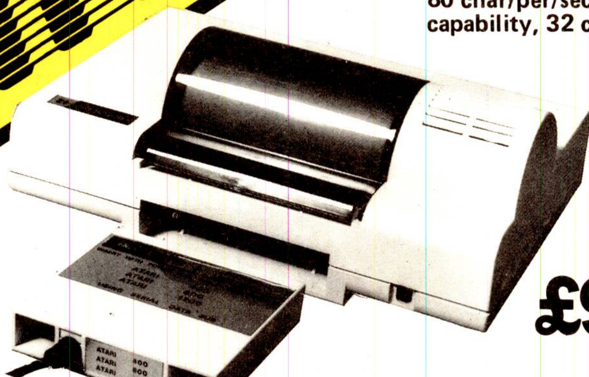
range of 32, 40 and 80 column

HIGH-SPEED THERMAL PRINTERS

Alphacom 32

Fully interfaced to SPECTRUM and ZX81. Uses standard Sinclair print commands (COPY, LLIST, PRINT). Print speed 80 char/per/sec, 256 x n dot graphic capability, 32 column width.

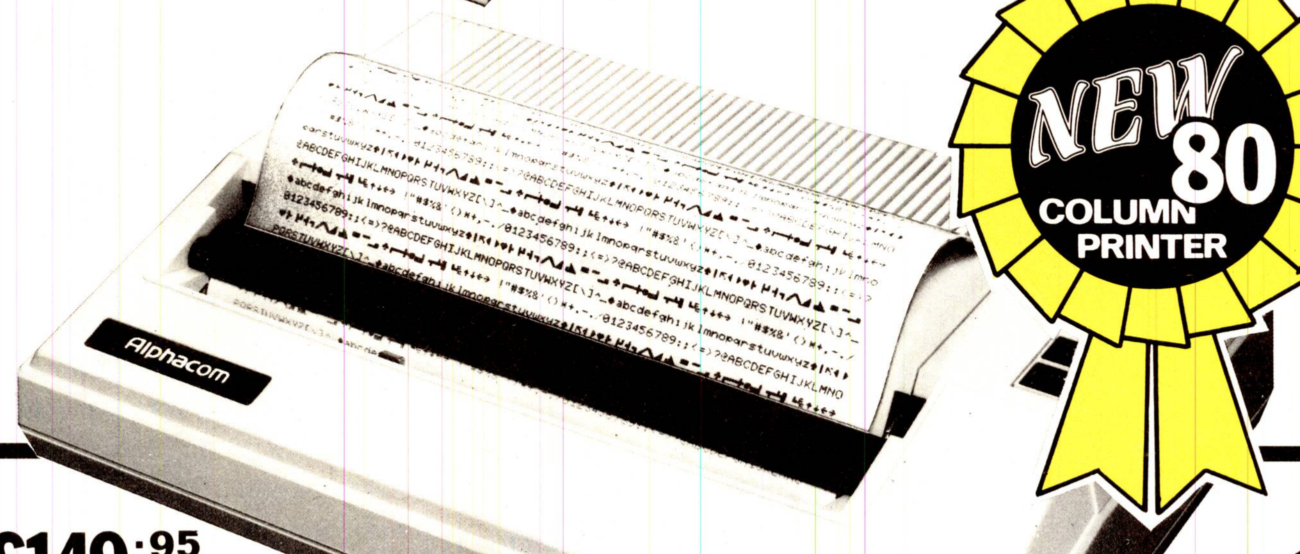
£69·95 Add £2 p.p.



Alphacom 42

With plug-in interface modules for — Commodore 64/Vic 20, Atari (all models), BBC B Centronics, Dragon and RS 232. Print speed 80 char/per/sec, 320 x n dot graphic capability, 40 column width.

£99·95 Add £2 p.p.



NEW 80 COLUMN PRINTER

£149·95 Add £2.50 p.p.

Alphacom 81

An 80 column thermal printer (8¼ ins paper width). Print speed 100 char/per/sec with full graphic capability and line feed advance.
For Commodore 64/Vic 20, BBC B Centronics, Atari (all models), Dragon and RS232. To the printer, simply plug in the interface module applicable to your computer (similar to model 42 above). Each module supplied includes the appropriate self-test programme. Additional interface modules available separately.

DEAN ELECTRONICS LIMITED
Glendale Park Fernbank Road Ascot Berkshire SL5 8JB
Telephone 0344 885661 Telex 849242

Please send .... ALPHACOM 32 @ £71.95 } and .... boxes of paper @ £12 (10 rolls)
.... ALPHACOM 42 @ £101.95 }
.... ALPHACOM 81 @ £152.45 and .... rolls of paper @ £5.50 (2 rolls)
To be used with computer ....
Total £.............PO/Cheque enclosed or debit Access/Barclay
Card Account No. ....
Name/address ....

Or from branches of: W H Smith, John Menzies, Greens, John Lewis Group, Spectrum Group.

Small business can now stop going by the book.

For under £1,000 a small business can now equip itself with a BBC Microcomputer, a disc drive, a word processor and printer.

(All tax deductible by the way.)

Once you've parted with that money, you'll find that business has never been brisker.

Because now, there's a new series of floppy disc software specially for the smaller business.

It has been developed by Acornsoft, the software division of Acorn Computers who are the manufacturers of the BBC Micro.

For only £24.95, each disc can store volumes of vital bookwork which can be updated and amended in a fraction of the conventional time.

And there is a disc to cover most aspects of paperwork and book-keeping.

The Invoicing package.

This program stores details of products, VAT numbers and, of course, the names and addresses of your customers. As orders come in, you simply record them. Then, when it's time to invoice, you just press a few keys and each invoice or credit note is printed automatically in seconds.

Allowing for variable terms of trading, the system calculates and prints discounts. And it should help to improve your cash flow dramatically.

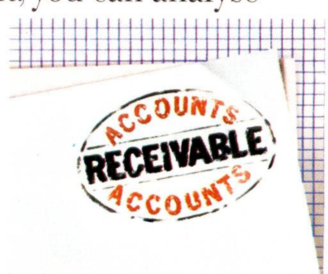
The Order Processing package.

With this program, you can confirm your customers' orders, prepare and print despatch notes and make fast analyses of individual orders or of all the orders stored on disc.

The Accounts Receivable package.

Now, it couldn't be easier to keep your customer accounts under control.

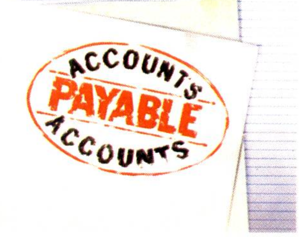
In an instant, you can analyse debtors, produce statements, keep a check on any credit limit and calculate VAT output automatically.



Using this package in conjunction with the invoicing package, you can also keep tabs on payments received against payments outstanding.

The Accounts Payable package.

This package will keep you fully up-to-date on how much you owe and who to. In addition, it calculates



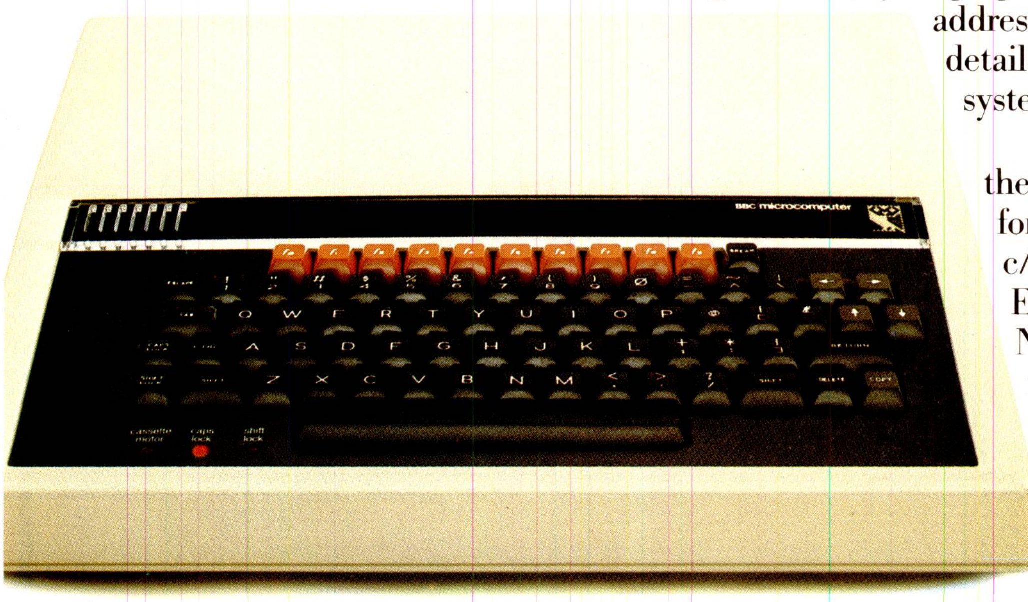
input VAT and, used with the Accounts Receivable package, produces instant VAT returns.

It also highlights settlement discounts, produces remittance advices and provides an immediate analysis of all creditors.

The Stock Control package.

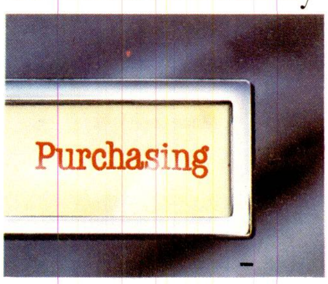
Touch a few keys and you have instant access to stock status and automatic analysis by quantity and value.

Consequently, it's easy for you to maintain correct stocking levels, having an early warning of out-of-stock situations or the likelihood of over-stocking.



The Purchasing package.

All your suppliers' names and addresses go onto the disc. Then they can be retrieved instantly for preparing and printing orders.



All order data can be recalled in seconds, allowing you to check on orders, and suppliers' invoices and to record all deliveries.

The Mailing package.

Instead of the shotgun method of sending mailshots, this package enables you to refine each mailing down to the customers who are most likely to respond.

It gives you a rapidly accessible mailing file of your customers, according to any criterion you choose. Size of company, for instance, or type of business. Average value of the business they do with you, or whether they are good or bad payers.

Then, when you are doing a mailing, you simply choose the group or groups of customers you want.

At £24.95 each, these packages could be priceless.

Each package comes with clear instructions on how to get the program running so that you can devote much more of your time to more profitable activities.

If you're a credit card holder, you can order any or all of the packages by ringing: 01-200 0200 anytime. Or 0933 79300 during office hours.

(By ringing the same number, you can get the address of your nearest stockist, or full details of the BBC Microcomputer system if you don't already have one.)

Alternatively, you can order the packages by sending the order form below to: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL. Please allow 28 days for delivery.

☎ Credit card holders, phone 01-200 0200, anytime. Or 0933 79300, during office hours.

To: Acornsoft, c/o Vector Marketing, Denington Estate, Wellingborough, Northants NN8 2RL.
Please send me the following business software packages at £24.95 each.

PROGRAM	QUANTITY	TOTAL	(Code Acornsoft use only.)
Invoicing			SNB 08
Order Processing			SNB 12
Accounts Receivable			SNB 10
Accounts Payable			SNB 13
Stock Control			SNB 11
Purchasing			SNB 14
Mailing			SNB 09
	TOTAL		

I enclose PO/cheque payable to Acornsoft Ltd. Or charge my credit card.

Card Number ____________________

Amex/Diners/Visa/Access (Delete)

Please send me details of the BBC Microcomputer System ☐

Name ____________________ PW7

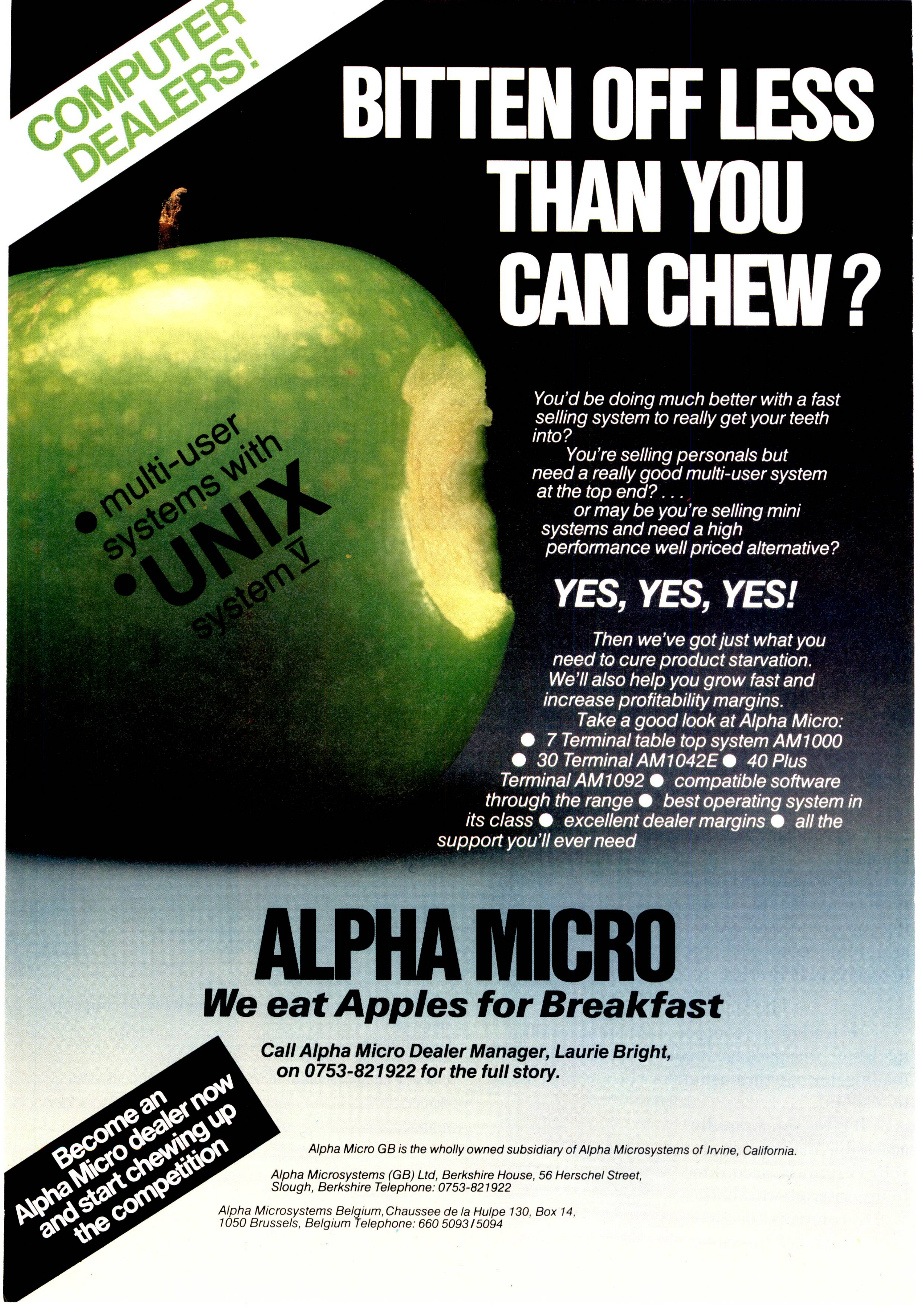
Address ____________________

____________________ Postcode ____________

Signature ____________________

Registered No. 1524763 VAT No. 215 8123 85

ACORNSOFT


COMPUTER DEALERS!
BITTEN OFF LESS THAN YOU CAN CHEW?
• multi-user systems with
• UNIX system V
You'd be doing much better with a fast selling system to really get your teeth into?
You're selling personals but need a really good multi-user system at the top end? . . .
or may be you're selling mini systems and need a high performance well priced alternative?
YES, YES, YES!
Then we've got just what you need to cure product starvation. We'll also help you grow fast and increase profitability margins.
Take a good look at Alpha Micro:
● 7 Terminal table top system AM1000 ● 30 Terminal AM1042E ● 40 Plus Terminal AM1092 ● compatible software through the range ● best operating system in its class ● excellent dealer margins ● all the support you'll ever need
ALPHA MICRO
We eat Apples for Breakfast
Call Alpha Micro Dealer Manager, Laurie Bright, on 0753-821922 for the full story.
Become an Alpha Micro dealer now and start chewing up the competition
Alpha Micro GB is the wholly owned subsidiary of Alpha Microsystems of Irvine, California.
Alpha Microsystems (GB) Ltd, Berkshire House, 56 Herschel Street, Slough, Berkshire Telephone: 0753-821922
Alpha Microsystems Belgium, Chaussee de la Hulpe 130, Box 14, 1050 Brussels, Belgium Telephone: 660 5093/5094

Consider our s professional

If you ever have to bring work home from the office you can now tackle it in a fraction of the time, thanks to our range of software.

With these inexpensive new programs you can turn a Commodore 64 personal computer into a fully-fledged business tool to improve the smooth operation of your calculations, filing and ordering or information storage.

All the programs are easy to learn and use, and all cost less than £50.

There's no more cost effective way to turn your home computer to practical use.

Practicalc 64. The complete spreadsheet for Commodore 64.

With this program your cashflow will do just that.

Flow.

Practicalc 64 accepts both numerical and alphabetical entries and allows you to work out sales forecasts, long-term budgets, sales models or long term cash plans.

All in a fraction of the time they normally take.

Practicalc 64 has 2000 cells, more than 20 mathematical functions, (including logarithms and roots), can insert or delete rows or columns, can 'SORT' information alpha-numerically and has a 'SEEK' function to search for specific information.

It can even display the information in graph form to allow a quick visual appraisal of the situation. Disc £44.50 (Tape £39.95).

Practifile 64. The database for Commodore 64.

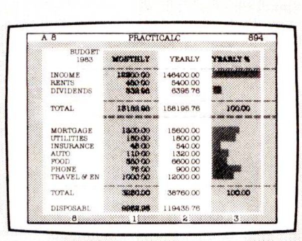
Practifile means an end to bulky and time-consuming storage of files, client or patient information or names and addresses.

And it means you'll no longer have to spend minutes or hours searching through piles of paper for a specific piece of information.

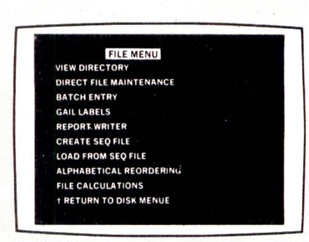
Each file on the program is able to handle 3,800 record entries, and Practifile can sort the files it contains by number or letter in less than a second.

The system is so flexible that you can add, subtract, multiply or divide within individual files, while its use with a word-processing system means that you

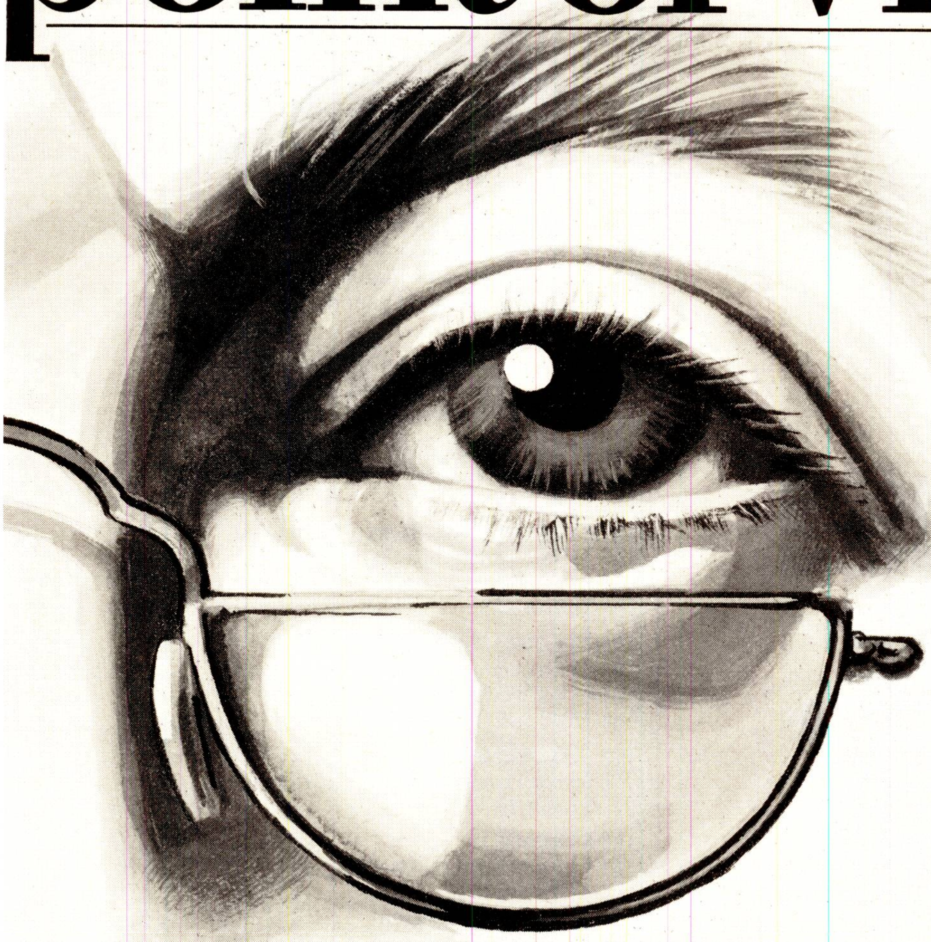
Over 20 mathematical functions. Column width up to 38 characters 2000 cells. Graph function.



Sorts files by number or letter in less than one second. Fully compatible with Practicalc 64.



oftware from a point of view.



can have instant 'hard-copies' in a matter of minutes.

While Practifile means instant access to mailing lists.

At just £44.50 you won't find a more versatile, flexible and professionally useful data-base.

Inventory 64. The quick, reliable inventory system.

With its capacity of 650 items, Inventory 64 is ideal for the average small business, and means a vast improvement in the efficiency of good stock control.

All you have to do is to enter each item, followed by the information which the program will prompt.

That means things like part number, description, location, stock, year-to-date sales, re-order date, minimum quantity, vendor, list price and other important facts.

From this information your personal computer, with the help of Inventory 64, will be able to collate and assess the major points of an efficient system and be able to present you with a complete and instantaneous view of current stock situations.

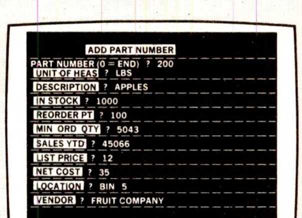
And ensure that stock control problems really are a thing of the past.

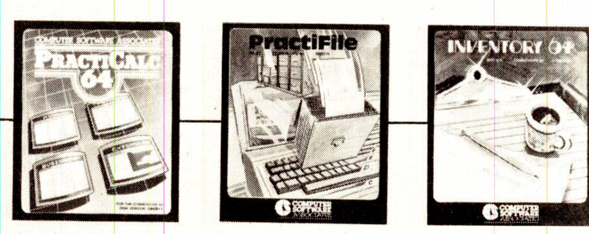
Pretty good value at just £29.95.

You'll find our superb range of Commodore 64 software for professional and business use in all good computer stores including selected branches of Boots, W. H. Smith, Menzies and Laskys.

If you'd like more information about our software or require any technical help fill in the coupon or phone us on 0473 462721.

Handles up to 650 parts. The quick answer to stock control problems.





Name

Address

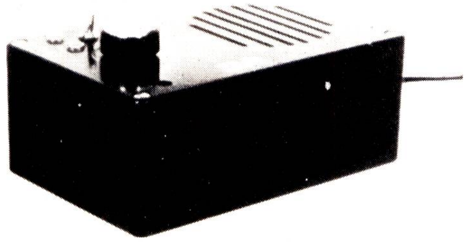
PRACTICORP

Goddard Road, Whitehouse Industrial Estate, Ipswich IP1 5NP. Tel: 0473 462721

ZEAL

SOUND BOOSTER

FOR SPECTRUM



- Plug in and use—no internal connections
- No batteries needed
- Good, clear sound
- Output control
- Load/Save facility built in
- Fully guaranteed

BRING THE SOUNDS OF YOUR GAMES TO EXCITING LIFE FOR JUST £14.99 (incl. VAT & P&P)

NEWSFLASH!

14" MICROVITEC Colour Monitor

SPECTRUM Compatible

£285 (incl. VAT & carriage)

16K RAMPACK for ZX-81

£17.50 (incl. VAT & P&P)

Please send me (enter quantity in box)

☐ Sound Boosters @ £14.99

☐ Colour Monitors (Spectrum Compatible) @ £285

☐ Rampacks for ZX-81 @ £17.50

Above prices include VAT/P&P/Carriage

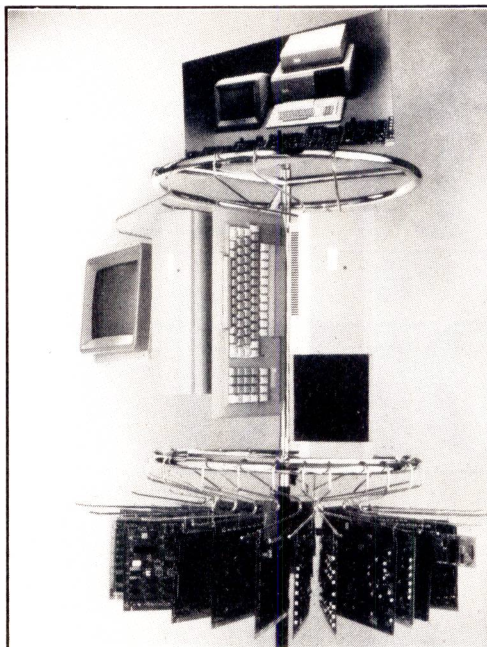
Name...

Address ....

....

I enclose Cheque/P.O. for £....................

ZEAL MARKETING LIMITED
Vanguard Trading Estate, Storforth Lane, Chesterfield S40 2TZ. Tel: 0246 208555



The Microvalue Group dealers shown below represent part of the Gemini network.
For expert advice and full details on the Gemini System, contact your nearest dealer today.

AMERSHAM COMPUTER CENTRE LTD
18 Woodside Road, Amersham, Bucks HP7 0BH
Tel: 02403 22307 Telex: 837788

BUSINESS & LEISURE LTD
16 The Square, Kenilworth, Warwickshire CV8 1ED
Tel: 0926 512127

CENTIFLEX MICROSYSTEMS LTD
Unit 6, Perry Road, Staple Tye, Harlow, Essex CM18 7NW
Tel: 0279 442233

ELECTROVALUE LTD
28 St. Judes Road, Englefield Green, Egham, Surrey TW20 0HB
Tel: 07843 3603 Telex: 264475

E.V. COMPUTING
700 Burnage Lane, Manchester M19 1NA
Tel: 061-431 4866

HENRYS RADIO
404 Edgware Road, London W2
Tel: 01-402 6822

LEEDS COMPUTER CENTRE
55 Wade Lane, Merrion Centre, Leeds LS2 8NG
Tel: 0532 458877

OFF RECORDS LTD
Computer House, 58 Battersea Rise, Clapham Junction, London SW11 1HH
Tel: 01-223 7730

PARKSTONE ELECTRONICS LTD
18 Station Road, Lower Parkstone, Poole, Dorset BH14 8UB
Tel: 0202 746555

SKYTRONICS LTD
357 Derby Road, Nottingham NG7 2DZ
Tel: 0602 781742

TARGET ELECTRONICS LTD
16 Cherry Lane, Bristol BS1 3BG
Tel: 0272 421196

NEWBURN ELECTRONICS LTD
58 Manse Road, Ballycarry, Carrickfergus, N. Ireland BT38 9LF
Tel: 09603 78330

MULTIBOARD COMPUTERS

Gemini Microcomputers

If you are a standard size and all your clothes fit you perfectly, you're the rag trade's ideal customer.

But, for most of us, buying a new outfit is far from simple: right size but wrong colour, right colour but wrong size, sleeves too short, legs too long...

CUSTOMISED COMPUTERS

at off-the-peg prices

. . . With a Gemini all you have to do is decide what you want your micro based system to do for you.

Each system can be tailored to individual needs. No wasted capacity so no wasted money. Add to that a choice of hundreds of CP/M software packages and your Gemini system really starts to show its versatility. It's even flexible enough to allow a D.I.Y. system to be manufactured to your own specification.

And when your needs grow or diversify, so too can your Gemini's capabilities and memory. You can even integrate your system to link up to 31 terminals to give a full local area network.

If you want to know more about the technical 'ins and outs' of our remarkable and easily expandible modular system, just write to us for our brochure.

If you're not that interested in RAMs, ROMs, LANs and CPUs, then just pop into one of our customer-friendly, hand-picked dealers who will tailor a system to your needs.

Gemini produce a large range of compatible boards, ensuring the maximum flexibility and ease of upgrade in the expansion of any Gemini based computer system.
Whilst the Gemini system uses CP/M, the addition of a 16 bit card will allow you to run many popular programs now being generated.

MULTIBOARD COMPUTERS

Gemini Microcomputers

Setting Fashion Trends

Gemini Microcomputers Ltd, 18 Woodside Road, Amersham, Bucks, England. HP6 0BH. Tel: (02403) 28321. Telex: 837788

☐ Please send me further information on the remarkable and easily expandible Gemini modular system
☐ Please send me the name and address of my nearest customer-friendly Gemini dealer
(Please tick)

Name ....

Address ....

Post code ....

Tel. No. ....

POST TO: GEMINI MICROCOMPUTERS LIMITED

How co

is comp

These days, choosing a personal computer for your business, should be easy.

After all, most of tomorrow's software is being written for one computer system. So, all you need is a computer that's compatible with that system.

Unfortunately, there are degrees of compatibility. And the average personal computer is sadly nothing more than a compromise.

While they claim to be compatible, they can let you down in a number of ways.

STC

Some, for instance, only run a fraction of the many hundreds of proven software packages.

Some don't accept the standard 5¼" floppy disk that these programs come on. So, even if the machine could run the program the disk wouldn't fit.

And quite a few personal computers fall short when it comes to linking up with important add-ons.

The new XTRA from STC has been designed to do away with these problems.

Being operationally compatible with the IBM PC/XT it can boast the highest level of compatibility yet achieved. And, because it comes from STC, you can rely on the full service back-up of a long established and respected company.

Other major advantages of the XTRA include

STC BUSINESS SYSTEMS LIMITED: MICROCOMPUTERS · DATA TERMINALS · WORD PROCESSORS · TELEX · FACSIMILE · TELEPHONE SYSTEMS

npatible
patible?

a central processor unit that's smaller than comparable systems. And if you're still cramped for desk space, you can even turn it on its side.

Experts will be glad to know that even our basic model is crammed full of 128 KB of RAM with an extra 128 KB available on the mother board.

And, while we're being technical, we should mention the 10 MB hard disc option. It all adds up to more memory than an elephants' graveyard.

As if all that isn't enough, the XTRA also keeps five expansion slots available to add even more memory and adapt to all your future needs.

But, the XTRA isn't just technically superior.

It looks better, too.

It has an easier to use keyboard and a screen that tilts and swivels for more comfortable viewing.

Even IBM didn't think of that.

So, before you're tempted by any old 'compatible', think how much XTRA you could have.

For a list of local dealers dial 100 and ask the operator for Freefone XTRA.

XTRA
Personal Computer.

STC BUSINESS SYSTEMS, BUSINESS MICROCOMPUTERS, MAIDSTONE ROAD, FOOTS CRAY, SIDCUP, KENT DA14 5HT. TELEPHONE 01-300 7788.

NOW
U-COM2 SYSTEMS

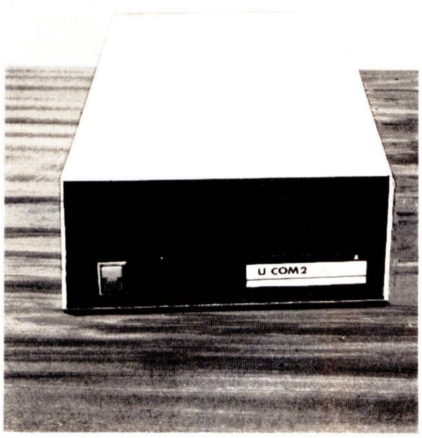
By popular demand complete systems based on our U-COM2 compatible motherboard. The U-COM2 is a 64K 6502 CPU motherboard with 8 expansion slots, game socket, speaker output and keyboard connector. It has a 2K software support EPROM which allows UCSD p-system, DOS 3.3, (with Z80 card) to be used as well as MPSL BOS and other more specialist systems to be run. An estimated 16,000 application software packages are available for the U-COM2 and many companies produce interfaces and other hardware add-ons.

System 1. The U-COM2 System 1 features the U-COM2 packaged into a robust rectangular case with power supply, mains switch and speaker. It is intended for use in the factory or laboratory as a dedicated controller with interfaces from the range from U-Microcomputers or other suppliers. You can load software into it from disc drive, ROM card or network interface. A 40 col display card is available as an option.

System 2. The U-COM2 System 2 features the U-COM2, a rectangular case with power supply, mains switch, speaker, four disc drive controller, one slimline disc drive (140KB), 40 Column display card and separate keyboard with numeric pad. A further disc drive can be ordered already fitted or as a separate add-on (see below).

To Order

System 1			
4-1500	U-COM2 System 1	Controller	£349.00
4-1100	U-COM2/40	40 Column Display	£ 39.00
System 2			
4-1550	U-COM2 System 2	One drive system	£599.00
4-1554	U-COM2 System 2	Two drive system	£748.00



And Accessories

MONITOR

Heres a really competitively priced 12" green screen monitor for 80 Column or 40 Column display.

To order

5-1020	U-VIEW Monitor	£69.00

CARDS

Choose from our wide range – further details on request.

NEW cards			
2-1360	U-CCT	Clock, Calendar and Timer	£99.00
2-1250	U-PRINT 64	Printer card 64K	£199.00
2-1214	U-A/D	8 Channel, New version	£350.00
2-1215	U-A/D	16 Channel, New version	£350.00
Ramcards			
2-1021	U-RAM 16/32	Add-on 16K memory	£50.00
2-1020	U-RAM 32	Add-on 32K memory	£68.00
2-1030	U-RAM 64	Add-on 64K memory	£180.00
2-1040	U-RAM 128	Add-on 128K memory	£275.00
Interfaces			
2-1240	U-PRINT 16	Printer card 16K	£99.00
2-1242	U-PRINT CAB	Cent cab for U-P16/64	£15.00
2-1230	U-CENT	Centronics I/F	£59.00
2-1110	U-S232	Serial interface	£75.00
2-1120	U-PORT	8 serial interface	£195.00
2-1122	U-2PORT	2 serial interface	£120.00
2-1130	U-BCD	Panel meter I/F	£95.00
2-1220	U-DT	Digital I/O + timer	£105.00
Enhancements			
2-1310	U-Z80	Processor card	£95.00
2-1350	U-TALK	Speech synthesis	£40.00
2-1330	U-TERM	80 col dis and lc	£150.00
2-1331	40/80 SW	Switch for U-TERM	£13.00
2-1410	U-EXT	Slot extender	£9.50

DISK DRIVE

Compatible disc drives for the U-COM2 System 1 or additional drives for System 2 or other suitable micros. Includes case and 140KB capacity drive.

To order

10-4010	U-SAVE disc drive with Controller	£229.00
10-4011	U-SAVE disc drive w/o Controller	£149.00

SYSTEM SOFTWARE

Here's the operating systems available for the U-COM2 Systems 1 or 2 from U-Micros

UCSD p-system including Pascal	£165.00
UCSD Fortran	£120.00
DOS 3.3 with integer and FP Basic	£60.00
CP/M (with Microsoft Z80 card)	£250.00
Structured Basic (including DOS and FP Basic	£49.95

U-Microcomputers Ltd
Winstanley Industrial Estate, Long Lane
Warrington, Cheshire, WA2 8PR, England
Telephone 0925 54117 Telex 629279 UMICRO G

Dealer and OEM enquiries welcome.

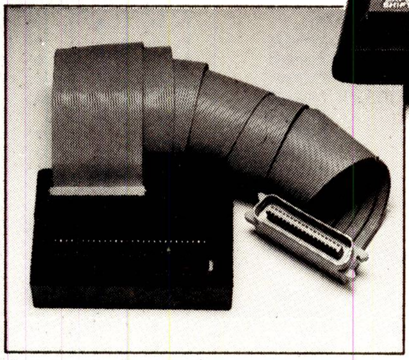
The U-COM2 Motherboard available separately.

U-MICROCOMPUTERS

THE INDUSTRY STANDARD INTERFACE

FULLY MICRODRIVE COMPATIBLE

From £39.99 Inclusive



At last you can have real print performance from your ZX Spectrum with the Kempston Centronics Interfaces. As the Interfaces allow you to link your ZX Spectrum to any of a vast number of printers with an industry standard centronics input, you can choose the printer that suits *your* needs – from high speed dot matrix to professional letter quality printers.

We recommend Epsons, NEC, TEC, Seikosha, OKI Microline, Tandy GP115, Star DP 510, Shinwa, Brother HR15, etc.

NEW **INTERFACE E** – ONLY £55.00
Simply plug in and it's ready to use. All operating commands are held in an EPROM so LLIST, LPRINT and COPY can be used at any time without using up valuable user RAM. COPY will allow the reproduction of high resolution graphics with Epson (or derivatives) and Seikosha 80, 100 and 250 Series printers. Print width selection from 32 characters to full width depending on printer used.

INTERFACE S – ONLY £39.99
Visually identical to Interface E but without the EPROM, Interface S also recognises the LLIST & LPRINT commands and will allow print width selection from 32 characters to full width.

However, software routines will need to be loaded before use. Full screen dump to reproduce high resolution graphics is also possible and supporting software is supplied to operate this facility with Epson and Seikosha printers. The software routines that are necessary to initialise the interface are held in the printer buffer so valuable user RAM will not be used up. There is a growing range of Business/Utility software that includes these routines. Details available on request.

Either interface simply plugs into the ZX Spectrum expansion port or interface and is supplied fully cased with a one metre ribbon cable which connects to the printer of your choice. Full instructions are included and driving software is supplied with Interface S.

KEMPSTON CENTRONICS INTERFACE COMPATIBLE SOFTWARE UTILITIES.
FOR THE 48K SPECTRUM.

FINANCE MANAGER (OCP) – Menu driven program for all domestic and business accounting applications. **£19.95**

ADDRESS MANAGER (OCP) – Simple index filing system ideal for names, addresses, etc. Various search facilities. **£19.95**

FULL SCREEN EDITOR/ASSEMBLER (OCP) – Allows you to write Z80 assembly code using standard mnemonics on full screen. **£19.95**

WORD PROCESSOR (TASWORD TWO) – (TASMAN) A professional word processor allowing 64 characters per line and incorporating all usual editing facilities. **£13.90**

OMNICALC (MICROSPHERE) – The only spreadsheet written entirely in machine code. The easy and fast way of solving any numerical problem. Ideal for cash flow forecasting to concrete stress analysis. **£9.95**

MASTERFILE (CAMPBELL SYSTEMS) – Filing and retrieval system for domestic or business use. Files can be loaded and saved independently. Microdrive compatible. **£9.95**

NOW WE CAN ALSO SUPPLY YOUR PRINTER.

We've looked at the printers currently available and have selected what we feel is best value for money in dot matrix and daisy wheel printers:

EPSON RX-80 F/T – A dot matrix printer allowing full graphics dumping and a choice of printing styles. Speed: 100 C.P.S.
Price £325 Inc. VAT and Delivery

BROTHER HR15 – A daisywheel printer ideal for letters, mail shots, documents, etc. Many typefaces available by changing daisywheel. Duplication facility but no graphics. Speed: Up to 18 C.P.S.
Price £425 Inc. VAT and Delivery

Interface S Available from
spectrum COMPUTER CENTRES
WHSMITH

All products direct from:

KEMPSTON MICRO ELECTRONICS LTD
Unit 30 Singer Way, Woburn Road Industrial Estate, Kempston, Bedford, MK42 7AF. Tel: (0234) 856633
Telex: 826078 KEMPMI G

All prices include VAT and P. & P. Overseas orders please add £4.00 P. & P.
Please allow 21 days for delivery of interfaces and software. Printers available within 48 hours.

TRADE ENQUIRIES WELCOME

For ZX Spectrum

A SELECTION FROM OUR PRODUCT RANGE

High Level Languages

		CP/M	CP/M-86	MS-DOS	PCDOS
ADA	Supersoft	●			
BASIC INTERPRETER	Microsoft	●		●	●
BASIC COMPILER	Supersoft		●	●	●
BASIC COMPILER V5.3	Microsoft	●		●	●
BUSINESS BASIC COMPILER	Microsoft			●	●
C COMPILER	Microsoft			●	●
C COMPILER	Supersoft	●	●	●	●
CBASIC	Digital Research	●	●		
CBASIC COMPILER	Digital Research	●	●		
CIS COBOL	Micro Focus	●	●		
COBOL COMPILER	Microsoft	●		●	●
FORTH	Supersoft	●			
FORTRAN	Supersoft	●		●	●
FORTRAN COMPILER	Microsoft	●		●	●
LEVEL-2 COBOL	Micro Focus	●	●	●	●
LISP	Supersoft	●			
muLISP	Microsoft	●			●
muMATH/muSIMP	Microsoft	●			●
PASCAL COMPILER	Microsoft			●	●
PASCAL MT+	Digital Research	●	●		
PL/1	Digital Research	●	●		

Low Level Languages

		CP/M	CP/M-86	MS-DOS	PCDOS
MACRO-80	Microsoft	●			
PROGRAMMERS UTILS (RASM)	Digital Research	●	●		

Program Development Tools

		CP/M	CP/M-86	MS-DOS	PCDOS
ANIMATOR	Micro Focus	●	●		
BUG	Phoenix Software	●			
DISPLAY MANAGER	Digital Research	●	●		
FTNUMB	Micrology	●			
LEVEL II ANIMATOR	Micro Focus	●	●	●	●
PDEVELOP	Phoenix	●			
PLINK	Phoenix	●			
PLINK II	Phoenix	●			
PLINK-86	Phoenix		●	●	●
SID	Digital Research	●			
SPEED PROGRAMMING PACKAGE	Digital Research	●	●		
XLT-86	Digital Research	●			
ZSID	Digital Research	●			

Utilities/System Tools

		CP/M	CP/M-86	MS-DOS	PCDOS
CLIP	Keele Codes	●	●	●	●
DESPOOL	Digital Research	●			
DIAGNOSTICS II	Supersoft	●	●		
DISK DOCTOR	Supersoft	●	●		
DISKED-2	Slogger Software	●			
DISK-EDIT	Supersoft	●	●	●	●
DISKMAN	Slogger Software	●			
DISKORG	Slogger Software	●			
DISKTOOLS-1 (DISKMAN & DISKORG)	Slogger Software	●			
DISKTOOLS-2 (DISKTOOLS-1 & DISKED-2)	Slogger Software	●			
dUTIL (FOR DBASE-II)	Fox & Geller	●			
FILESHARE	Micro Focus	●	●		●
DEC RAINBOW SERVICE S/W:	Silicon Valley Corp.				
(1) Format/Verify Service			●		
(2) Autorun Service			●		
(3) Function Key Service			●		
SERVICE S/W VOL. 1 (1, 2 & 3)			●		
SYSTEM CHECKER	Supersoft	●			
THE OPERATING GUIDE	Decision Systems	●			
UTILITIES I	Supersoft	●			
UTILITIES II	Supersoft	●			

Sorting

		CP/M	CP/M-86	MS-DOS	PCDOS
MSORT	Microsoft	●		●	●
SUPERSORT	Micropro	●	●	●	●

Code Generators

		CP/M	CP/M-86	MS-DOS	PCDOS
AUTOCODE	Stemmos	●		●	●
FORMS-2	Micro Focus	●	●	●	●
QUICKCODE	Fox & Geller	●		●	●
SOUCEWRITER	Softwright	●	●	●	●
THE LAST ONE	D.J. 'A1' Systems	●	●	●	●
THE LAST ONE—COMPACT	D.J. 'A1' Systems	●	●	●	●

Telecommunications/Conversions

		CP/M	CP/M-86	MS-DOS	PCDOS
BACDEBIT	Comley	●			
BACSCOPY	Comley	●			
BSTAM	Byrom Software	●	●	●	●
BSTMS	Byrom Software	●			

Telecommunications Cont.

		CP/M	CP/M-86	MS-DOS	PCDOS
ICL C03 EMULATION (Bulk)	Synchro Systems	●			
ICL C03 EMULATION (Interactive)	Synchro Systems	●			
ICL C03 EMULATION (Interactive & Bulk)	Synchro Systems	●			
REFORMATTER CP/M ↔ DEC	Microtech Exports	●			
REFORMATTER CP/M ↔ IBM	Microtech Exports	●	●		

Word Processing/Text Editing/Editors

		CP/M	CP/M-86	MS-DOS	PCDOS
CORRECTOR	Supersoft	●			
EDIT-80 V2.02	Microsoft	●			
FRIDAY	Ashton Tate	●	●	●	●
MAILMERGE	Micropro	●	●	●	●
MEMOPLAN	Chang Labs	●	●		●
WORD	Microsoft				●
WORD WITH MOUSE	Microsoft				●
PARAGRAB	Focus	●		●	
PEDIT	Phoenix	●			
PMATE	Phoenix	●			
SPELLSTAR	Micropro	●	●	●	●
STARBURST	Micropro	●	●	●	●
STARINDEX	Micropro	●	●	●	●
WORDMASTER	Micropro		●		
WORDSTAR	Micropro	●	●	●	●
WORDSTAR PROFESSIONAL (WS + MM + SS + STAR INDEX)	Micropro	●	●	●	●

Databases/Data Management Systems

		CP/M	CP/M-86	MS-DOS	PCDOS
DATASTAR	Micropro	●	●	●	●
dBASE-II	Ashton Tate	●	●	●	●
INFOSTAR	Micropro	●	●	●	●
REPORTSTAR	Micropro	●	●	●	●

Financial Accounting

		CP/M	CP/M-86	MS-DOS	PCDOS
INCOMPLETE RECORDS SYSTEM	MPI	●	●	●	●
NOMINAL LEDGER	Padmede	●		●	●
OPEN ITEM PURCHASE LEDGER	Padmede	●		●	●
OPEN ITEM SALES LEDGER	Padmede	●		●	●
PADMEDE BUSINESS CONTROL SYSTEM	Padmede	●		●	●
PAYROLL	MPI	●			
PURCHASE LEDGER	Padmede	●		●	●
SALES INVOICING	Padmede	●		●	●
SALES LEDGER	Padmede	●		●	●
TIME & COST RECORDING	Padmede	●		●	●

Financial Modelling/Problem Solving

		CP/M	CP/M-86	MS-DOS	PCDOS
CALCSTAR	Micropro			●	●
DECISION ANALYST	Executive Software		●	●	●
LINEAR & GOAL PROGRAMMING	EAS	●			
MATHSPACK	MPI	●		●	●
MICROPLAN	Chang Labs	●	●		●
MULTIPLAN	Microsoft	●		●	●
PLANTRAC 1	Computerline	●		●	●
PLANTRAC 1+	Computerline	●		●	●
PROFIT PLAN	Chang Labs	●			●
QSTAT	Pivotal Software	●			
STATSPACK	MPI	●		●	●
TK! SOLVER	Software Arts				●
TK! SOLVER PACKS					
FINANCIAL MANAGEMENT					●
MECH ENGINEERING					●

Business Applications

		CP/M	CP/M-86	MS-DOS	PCDOS
JOB COSTING	Heseltine	●	●	●	●
POLICY MASTER	CSA Micro Systems	●	●	●	●
PRINT ESTIMATION	Software Mgmt Systems	●		●	●
STOCK CONTROL	Padmede	●		●	●

Training Aids

		CP/M	CP/M-86	MS-DOS	PCDOS
CP/M TUTOR	Syntax Software	●			
KEYBOARD MASTER	Anthony Ashpitel	●	●		●
TYPING MASTER	Anthony Ashpitel	●	●		●

Graphics

		CP/M	CP/M-86	MS-DOS	PCDOS
dGRAPH	Fox & Geller	●			●
STATSGRAPH	Supersoft	●			

MPI

MICROCOMPUTER PRODUCTS INTERNATIONAL LIMITED

Room PL3,
Central House,
Cambridge Road,
Barking,
Essex IG11 8NT.
Tel: 01-591 6511
Telex: 892395

THE HOME OF MICROCOMPUTER SOFTWARE

A MUSIC MATE FOR BUDDING BACHS

A brand new program that takes the computer away from the mundane world of business and commerce and into the rarefied world of music. Music Mate helps the experienced musician to quickly and accurately write music scores, using a matrix printer, and helps the inexperienced to arrange melodies and even compose tunes.

The package has been developed by Hi-Yin Music, a company built around the talents of composer and arranger Per Hartmann. He has written the package to help arrangers prepare music manuscripts both quickly and easily. That however, is just one of the capabilities available with Music Mate. It can also be used to produce an arrangement of a melody for up to 14 instruments.

In its simplest role, Music Mate can be used to drive a matrix printer so that it can print out a full musical score. The composer enters the notes of a music score into the system by letter, ie A, B, C etc, with sharps and flats being shown by the # sign and lower case B (b) respectively. Rests are indicated by the letter P (bar pause) and note durations are designated numerically, with the smallest value being a sixteenth note. Octaves are shown numerically, with octave 0 being the lowest.

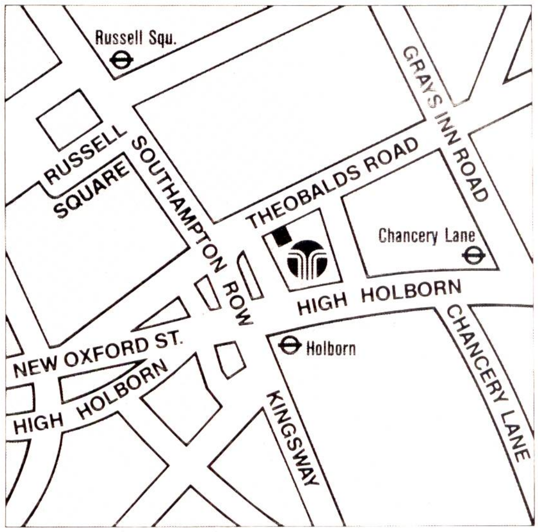
The system will request, in addition, the names of the instruments to be scored, their clefs, and the key signature (if any) of the music.

From this information the system will then be able to drive a matrix printer to print out a complete score of the music. Each part will be identified for the instrument desired and be ready to play. It will save a great deal of time and effort in producing the written arrangements to a piece of new music.

Music Mate goes further, however. Using probabilistic techniques, the programme can be used to generate melodies itself or to provide arrangements to an existing melody line. To stop the computer picking any notes, octaves, note durations and instruments at random, the user sets up a table of weighted probabilities. These set the likelihood of any particular note, duration, instrument or octave appearing in the score. Once the score has been produced by the computer the package allows the composer the chance to modify and manipulate the music so that it can be tailored to suit requirements. The score can be transposed, for example, to a different key, or swop notes or octaves around.

Without doubt, Music Mate is truely a musical "word processor".

A LITTLE MAP TO HELP YOU THROUGH THE MICRO-COMPUTER MAZE



Somewhere amongst the pages of this magazine there probably lies an ideal combination of hardware and software that would suit your needs, now and in the years to come.

However, making sense of a large number of similar sounding claims and actually locating this elusive combination can often prove to be next to impossible.

At Transam we have one of the widest ranges of business and portable micros in London. This enables us to explain, demonstrate and compare systems and software and provide you with the advice you need to help you identify the most appropriate combination to suit your own particular needs.

Apart from being authorised dealers for IBM, ACT, EPSON, SHARP, & NEC we also design and develop our own highly successful range of hardware and software, including the new WREN Executive System.

To find your way out of the micro-technology maze you only have to locate our West End showroom, (which is why we have thoughtfully supplied the small map above).

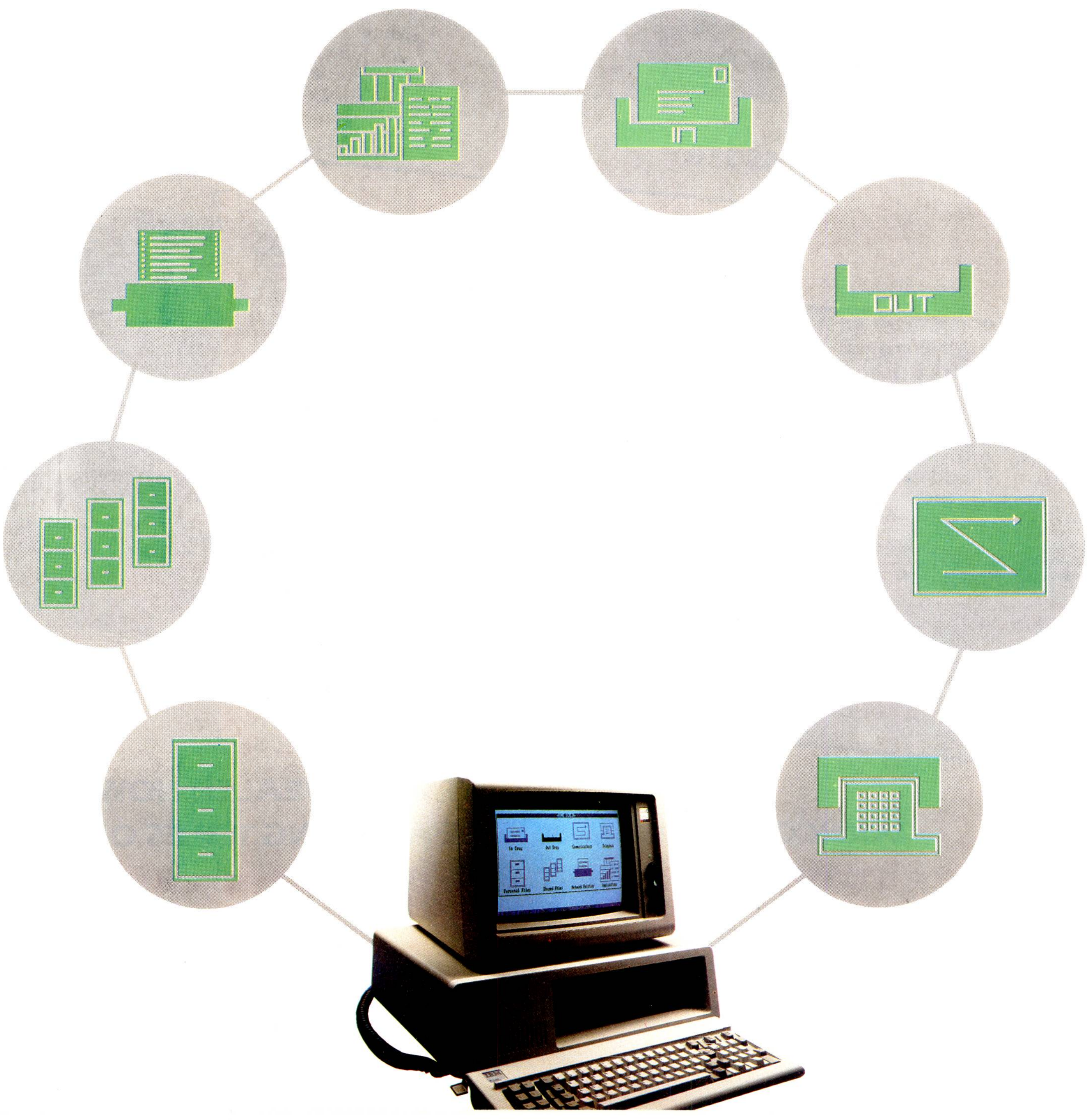
Transam
MICROSYSTEMS LIMITED
59/61 Theobalds Road,
LONDON WC1X 8SF
Tel: 01-404 4554

The local area network

Meet ICON – the first local area network for PCs that can truly be called an office automation system. Graphic symbols (icons) and a mouse facility make ICON easy to learn and easy to use. In a fraction of the time needed with a conventional network system.

ICON combines networking, mail, communications and applications in one program that can perform all these functions interchangeably and instantly, at the touch of a key.

So now you can use your favourite PC application programs, send mail to a colleague, retrieve a spreadsheet file from a shared disk, telephone head office – effortlessly, within one program. ICON gives you a new level of power that's greater than the sum of its parts. Powerful enough to compare with Xerox Star or Lisa, at a fraction of the cost. On your IBM PC.

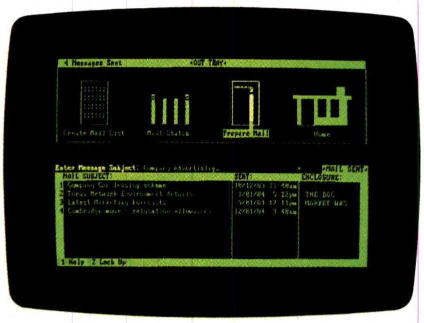


comes of age . . .

Ethernet networking

If ICON were only a network, you'd want it for that alone. ICON's plug-in network interface is built to full Ethernet specifications. That means a fast 10 Mbit/s data transfer rate, allowing you to network efficiently up to 100 PCs within a one-kilometre distance. It also means a standardised, future-proof solution to your network requirements. A solution that will be compatible with the fast-growing number of Ethernet network products from other manufacturers, including communications gateways and laser printers.

But unlike other networks, all ICON's networking software – file and printer servers, communications gateways and electronic mail – is included in the basic price. And ICON needs no dedicated machines since all servers can run as background tasks. As your requirements expand you can create as many servers as you need. Without purchasing more software.



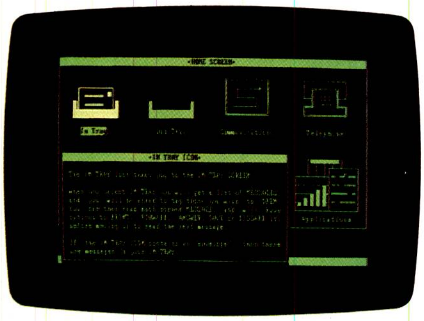
Electronic mail

ICON's mail system is the most comprehensive – yet the easiest to use – that you'll find on any PC network. We have even built in our own fully-integrated, mouse-controlled mail editor. Use icons to access a full set of electronic mail functions. Pick letters from your in-tray. Open them. Forward them on to other users. Select their names on the screen. Check who has read them. Then print your mail at a shared printer on the network. Simply. Effortlessly. With no tedious typing of commands.

Communications

Whether you're accessing the latest stock prices, or sending mail between offices and countries, ICON will get your information through faster. Select Telecom Gold from your PC. ICON will locate a free modem, autodial the number and even log you on. All with one keystroke. And because ICON allows you to share modems on the network your PC doesn't need to tie up your phone line.

But ICON's communication abilities go much further than this. A comprehensive telephone manager lets you store hundreds of telephone numbers on electronic 'index cards'. These cards can be used to hold names, important dates such as birthdays and even documents for display during your phone call.



Applications management

Tired of searching for floppy disks? ICON lets you install your application programs in a central library, then access them from your IBM PC. Enter the library and you see an icon for each application. To run a program, simply select the appropriate icon with your mouse or cursor keys!

TORUS ICON

Help, and more help

If you ever get stuck using ICON, just press the HELP key. Instantly, a page of instructions appears in a window on the screen. Over 450 pages of on-line help information to guide you out of trouble. And an UNDO feature to cancel your last command. Our on-line help facility can act as your electronic tutor, letting you explore and learn the system at your own speed.

Easy installation

Having made ICON so easy to use, our next challenge was to make it easy for you to install and manage from day to day. Configure your network and supervise system activities from the network manager station. Set up and monitor server stations with the server manager program. Using the same simple ICON user interface. And all accessed from within the integrated ICON system.

And more

Torus ICON was designed to be flexible and expandable. Torus is committed to enhancing the ICON system with a number of forthcoming products, including Prestel communications and support of multi-user application packages.

To understand fully just how much power ICON adds to your IBM PC, you will want to go to your nearest Torus ICON dealer for a full demonstration. For his name and address or further information, phone Torus on 0223 862131, or write to us at 21 Science Park, Milton Road, Cambridge CB4 4BH.

DIRECT DISK SUPPLIES

OUR NAME SPEAKS FOR ITSELF

DDS VALUE FOR MONEY PRICES
FAST DISK DELIVERY — CHEAPEST PRICES

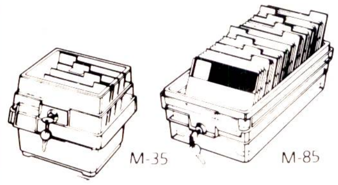
DDS PRICE MATRIX

Easy pricing. Use the DDS Price Matrix for the right price first time. Or DIAL-A-DISK, for firm quoted prices.

	3M			Verbatim® Datalife 5 year warranty			maxell®		
5.25″ single sided disks	Code	1-9 boxes	10+ boxes	Code	1-9 boxes	10+ boxes	Code	1-9 boxes	10+ boxes
double density 48tpi	744	14.99	13.99	525	17.99	15.99	MD1-D	22.99	20.99
quad density 96tpi	746	22.99	20.99	577	24.99	22.99	MD1-DD	30.99	28.99
5.25″ double sided disks	Code	1-9 boxes	10+boxes	Code	1-9 boxes	10+boxes	Code	1-9 boxes	10+boxes
double density 48tpi	745	21.99	19.99	550	25.99	23.99	MD2-D	30.99	28.99
quad density 96tpi	747	26.99	24.99	557	32.99	30.99	MD2-DD	41.99	39.99
p&p per 10 disks		.75	FOC		.75	FOC		.75	FOC
8″ diskettes	Code	1-9 boxes	10+ boxes	Code	1-9 boxes	10+ boxes	Code	1-9 boxes	10+ boxes
s′gle sided s′gle density	740.0	22.99	22.49	FD34-9000	25.99	24.79	FD1-128	26.09	25.49
s′gle sided d′ble density	741	29.99	29.09	FD34-8000	26.49	25.59	FD1-XD	29.09	28.49
d′ble sided d′ble density	743.0	34.49	33.49	DD34-4001	30.99	30.19	FD2-XD	37.39	35.89
p&p per 10 disks		1.50	FOC		1.50	FOC		1.50	FOC

	1-9	10+
See-10 library box	1.99	1.75
p&p per See-10	.75	.30
ABA lockable boxes		
M35 — 40 disks	13.99	12.99
M85 — 80 disks	16.99	15.99
p&p per ABA box	1.75	FOC
(Carriage at cost on 3-9)		

SEE10



DIAL-A-DISK
Order Hotline
☎ 01-541 1144
Answering service for out of hours orders

Sony 3.5″ Disks	From £38.99
Memorex 3.5″ Disks	per box of 10
Maxell 3″ Disks	plus p&p 75p

Prices per box of 10 disks excluding VAT

HOW TO ORDER:

1. Complete the coupon and post with your cheque using our FREEPOST address. A first class stamp gets it to us next day.
2. Urgent orders: DIAL-A-DISK 01-541 1144. Dictate your order with ACCESS or VISA and they're as good as received.
3. Collect from our office, phone and they will be waiting for you between 10.00 and 17.00 weekdays. (Other times by arrangement).
4. Next day delivery £7.50.
5. Crucial Orders: Same day delivery by quotation.
6. Official Orders: Orders from Government Departments, Local Authorities, Universities, Schools, etc, are very welcome and receive immediate attention.
7. Telex Orders: To 932905 (Larch G) attention LAN.

All offers and prices subject to change without notice.

DDS

Direct Disk Supplies Ltd., 29 Dagmar Road, Kingston, Surrey KT2 6DP

To: Direct Disk Supplies Ltd., FREEPOST, 29 Dagmar Road, Kingston, Surrey KT2 6BR. PCW/7/84

Code	Qty	Description	Price

Name ______________________ Nett price

Address ______________________ Carriage ______

______________________ Subtotal

______________________ VAT 15% ______

Postcode __________ Tel __________ Total payable to DDS £ ______

Cheques payable to DDS. Debit my Access/Barclaycard No:

Signature:

VISA

For IBM-PCDOS/CPM 8"/MS DOS
Small Business use
Diskett – sampler
New from Main Street

A small sample of what the MS Filer can do for your data.

Free program sampler

A limited number of diskettes are available free to give Small Business users a chance to make some test entries. Send now for your copy.

Gives you customised control

You get: on-screen prompting for fast learning/operation. Data input, range selection, search-and-sort time, report generation – all simplified. Automatically controls deletions, name/address generation, record/file copying, information protection. Also multiple print functions for paper/label uses.

Gives you decision time

The MS Filer works for first-time and experienced users as a tool for handling mailing lists, catalog-uing, indexing, job costing, inventory control, reminder-files, sales reports/analyses, and target marketing.

Your copy of this program

The Main Street Filer (all versions) is available from all good business computer software stockists. Recommended retail price £295.00 including VAT.

Send me (tick as required)

☐ The address of my nearest stockist
☐ **My free sampler** and programme specification
☐ Your full list of business products

Please allow 21 days for response.

To: Thorn EMI Computer Software Distributors
296 Farnborough Rd., Farnborough, Hants., GU14 7NF.

Name

Title

Company

Address

APCW3

THORN EMI
Computer Software Distributors

COMPUTER SOFTWARE DISTRIBUTORS FOR: CREATIVE SPARKS / HESWARE / IUS / MAINSTREET / TOTL / DATAMASTER / HUMAN EDGE

APRICOT

Introducing the new 4th GENERATION APRICOT computer from ACT, makers of the World-beating Sirius 1. With 256K RAM as standard and Supercalc, MS-DOS, C/PM 86 and concurrent CP/M 86 included in the incredibly low price this machine represents the very latest in business machine technology.

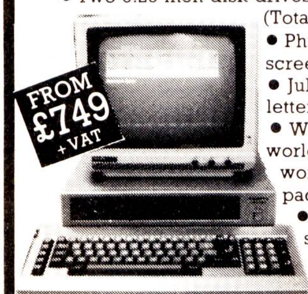
FROM £1449

PLUS FULL RANGE OF PULSAR BUSINESS SOFTWARE

SANYO

The Sanyo MBC-550 offers a low cost business system from a well-known manufacturer. For £1349.00 + VAT we will supply the machine as a ready-to-use word processing system with the following:-

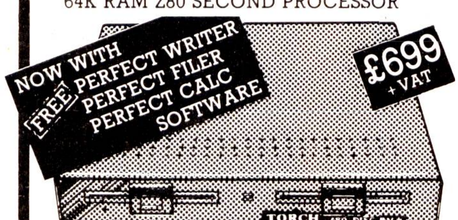
- 128K Random Access Memory
- Two 5.25 inch disk drives (Total capacity 320K)
- Philips 12" green screen monitor
- Juki daisy-wheel letter quality printer
- Wordstar, the worlds most popular word processing package
- Calcstar spreadsheet calculating package
- All necessary cables (and mains plugs!)
- Box of 10 blank diskettes



FROM £749 +VAT

TORCH
Z80 DISC PACK

800K DUAL DISK DRIVE
64K RAM Z80 SECOND PROCESSOR



NOW WITH FREE PERFECT WRITER PERFECT FILER PERFECT CALC SOFTWARE

£699 +VAT

FITTED FREE & WHILE-U-WAIT

NEW PRODUCTS FROM COMPSHOP WE MEAN BUSINESS

COMPSHOP WAS ESTABLISHED IN 1978 AND HAS CONTINUALLY OFFERED THE BEST IN MICRO COMPUTERS TO DISCERNING CUSTOMERS.

WE SELL ONLY COMPUTERS AND PERIPHERALS, AND THEREFORE CAN OFFER THE SUPPORT MANY OTHER SHOPS CANNOT.

All prices quoted are exclusive of VAT. Delivery is added at cost. Please make cheques and postal orders payable to COMP SHOP LTD., or phone your order quoting BARCLAYCARD, ACCESS, DINERS CLUB or AMERICAN EXPRESS number.

APPLE 2e

£489

Offers you more features & capabilities. 64K RAM, expandable to 128K. Upper & lower case text. 8 internal slots for expansion.

AUTHORISED APPLE DEALERS

SYSTEM 1

APPLE 2e 64K
DISK WITH CONTROLLER
80 COLUMN CARD
12" GREEN MONITOR

£849

SYSTEM 3

APPLE 2e 64K
DISK WITH CONTROLLER
ADDITIONAL DISK DRIVE
80 COLUMN CARD
12" GREEN MONITOR

£999

SYSTEM 4

APPLE 2e 64K
DISK WITH CONTROLLER
ADDITION DISK DRIVE ADDITIONAL
80 COLUMN 64K CARD
12" GREEN MONITOR
PRINTER INTERFACE CARD
EPSON RX80 FT PRINTER OR
REMSTAR DAISY WHEEL PRINTER
APPLEWRITER OR
QUICK FILE SOFTWARE

£1549

JUKI 6100

THE WORLD'S MOST POPULAR DAISY-WHEEL PRINTER

£349 +VAT

ALSO STOCKED

MICROLINE, TEC AND ANADEX PRINTERS
MICROVITEK, KAGA AND FIDELITY MONITORS
VERBATIM DISKETTES
SELMOR DESKS

COMP SHOP LTD

BARCLAYCARD VISA · Access · AMERICAN EXPRESS · DINERS CLUB INTERNATIONAL

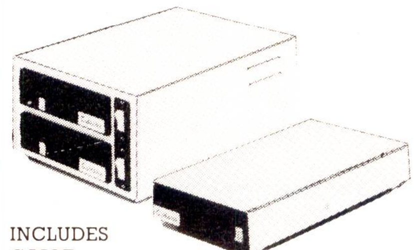
BBC MODEL 'B' MICRO

£347 +VAT

The BBC has become the most popular Educational Computer in Britain, not on gimmicks, purely on merit.

AUTHORISED BBC SERVICE AND INFORMATION CENTRE

BBC DISK SYSTEMS



INCLUDES CABLE, MANUAL AND FORMATTING DISK

CUMANA

FROM SINGLE £149 +VAT DUAL £305 +VAT

EPSON RX80 FT

£269 +VAT

ELITE, ITALIC, ENLARGED, CONDENSED, SUPERSCRIPT, SUBSCRIPT STYLES, 100 CPS, HI-RES. GRAPHICS, VARIABLE WIDTH TRACTOR.

ELECTRON EXPANSION

Professional Expansion Box for ACORN Electron, totally enclosed with up to 6 expansion slots for Printer/Joysticks/Sideways ROM/Disk Interface. £29.50 +VAT

Printer Interface Card £26.50 +VAT

Joystick Interface £19.00 +VAT

Sideways ROM (6 ROM sockets) £29.00 +VAT

Disk Interface (COMING SOON) TO BE ANNOUNCED

COMPSHOP PRICE PROMISE
WE GUARANTEE TO MATCH THE PRICE ON EQUIPMENT OFFERED FROM STOCK THROUGH ANY OTHER SUPPLIER.

EDUCATIONAL ENQUIRIES AND ORDERS WELCOME. QUOTATIONS GIVEN.
ONE YEAR WARRANTY ON ALL PRODUCTS

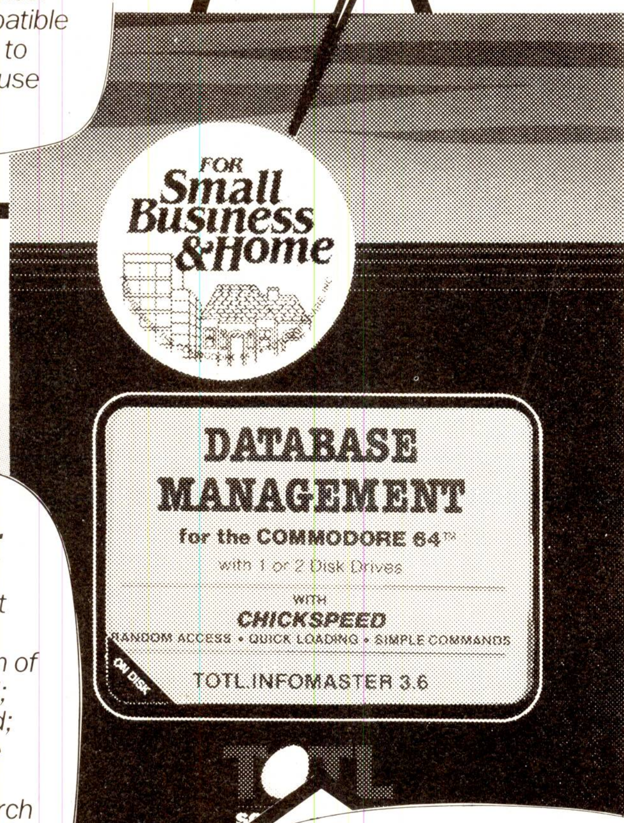
14 Station Road, New Barnet, Hertfordshire, EN5 1QW
(Close to New Barnet BR Station - Moorgate Line)
Telephone: 01-441 2922 (Sales) 01-449 6596
Telex: 298755 TELCOM G
OPEN (BARNET) - 10am - 7pm - Monday to Saturday

Commmodore 64
Small Business or home use
Diskette
New from TOTL

How to manage your time as well as your data.

Go for TOTL integration

Not only do you get a simple-to-operate high productivity program for your word processing, you also get the full potential of the TOTL range of compatible programs, allowing you to expand your computer-use interactively.



Program with TOTL Infomaster

This sophisticated but clear data management system gives you control over large-volume, complex information. Features include: maximum of 10 files per disk; 2,500 characters per record; 100 fields per record; 245 characters per field; disk-space your only limit on records; variable record, field definitions; unique key for fast access; records displayed in turn or by field-search selection; exceptional reporting capability – including design, sort-order, subtotals, selection criteria; reports generated in label format.

Call Product Line (0252) 518364

Use our specialist advice unit for queries on program use. This service is free to both users and stockists.

Your copy of this program

TOTL Infomaster (Cat. no. TOGE 42) is available from all good business computer software stockists. Recommended retail price £49.95 including VAT.

Send me (tick as required)

☐ The address of my nearest stockist

☐ A full specification for this programme

☐ Your full list of business products

Please allow 21 days for response.

To: Thorn EMI Computer Software Distributors
296 Farnborough Rd., Farnborough, Hants., GU14 7NF.

Name

Address

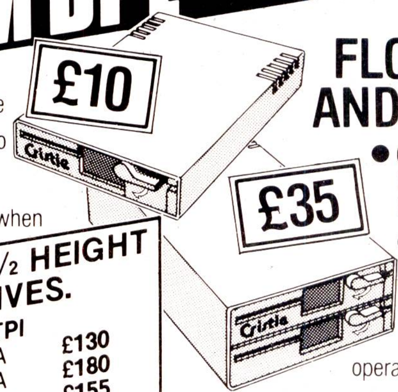
APCW4

THORN EMI
Computer Software Distributors

COMPUTER SOFTWARE DISTRIBUTORS FOR: CREATIVE SPARKS / HESWARE / IUS / MAINSTREET / TOTL / DATAMASTER / HUMAN EDGE

BBC NEWS FROM DPL

BBC COMPATIBLE FLOPPY DISC SYSTEMS AND DRIVES



£10

- Case to hold one drive
- Ribbon cable to connect one drive to BBC Micro
- Power cable to power one drive from BBC Micro
- Switch on rear of case to select 40 or 80 TPI operation when using FD55E or FD55F.

£35

- CASE to hold two drives (complete with blanking panel for use should only one drive be installed).
- Ribbon cable to connect **two** drives to B.B.C. Micro.
- Integral power supply for **two** drives.
- Switch on rear of case to select 40 or 80 TPI operation when using FD55E or FD55F.

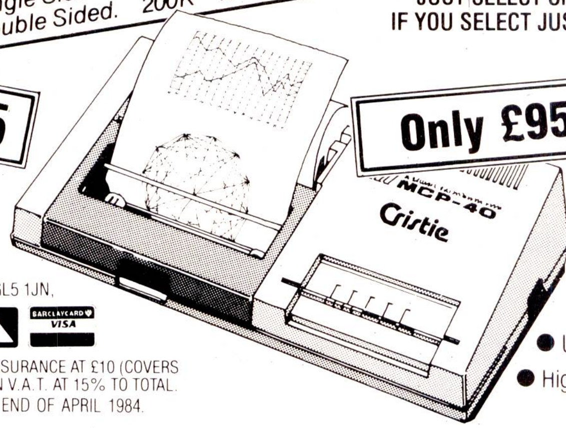
THIS CASE CONTAINS ALL HARDWARE NECESSARY FOR TWO DRIVES. JUST SELECT ONE OR TWO DRIVES FROM THOSE SHOWN BELOW. IF YOU SELECT JUST ONE NOW, THE SECOND CAN JUST PLUG IN LATER. CASES ONLY SOLD WITH DRIVES.

TEAC FD55 SERIES 5.25" ½ HEIGHT SLIM-LINE DISC DRIVES.

	Capacity 40TPI	80TPI	
FD55A 40 Track. Single Sided.	100K	N/A	£130
FD55B 40 Track. Double Sided.	200K	N/A	£180
FD55E 40 or 80 Track. Single Sided.	100K	200K	£155
FD55F 40 to 80 Track. Double Sided.	200K	400K	£218

£15 HANDBOOK AND FORMATTING DISC

PRINTER AND PLOTTER —MCP 40



Only £95

- 4 colours
- Selectable 40 or 80 characters per line
- Easy to use—simple software commands
- Standard Centronics interface— cables available for most micros
- Uses 4½" plain paper
- High resolution—over 100 steps/inch

ALL EX STOCK

DELIVERY: Up to 28 days.
WARRANTY: 90 days.
TERMS: Strictly cheque with order. Send to P.O. Box 11, Stroud, Glos. UK GL5 1JN, or phone through your Access or Barclay Card number.

TO ORDER: ADD CARRIAGE/PACKING/INSURANCE AT £10 (COVERS NEXT DAY SECURICOR DELIVERY). THEN V.A.T. AT 15% TO TOTAL. THE ABOVE PRICES ARE VALID UNTIL END OF APRIL 1984.

DIGITAL PERIPHERALS LTD. Rodney House, Church Street, Stroud, Glos. U.K. GL5 1JN Tel: (04536) 71387. Telex 43551.

A Cristie Company

PRINTER SHOCK FROM

SCI UK LTD.

PAGE 124

OPEN 7 DAYS A WEEK

NEC
COMPUTING PUBLICATIONS

Structured BASIC

Advanced BASIC programming course containing two types of material: first, on program style, design and structure and second, techniques of programming. Uses BBC BASIC but includes a special appendix on how to write structured programs in BASICs without structured features.

Book £7.50 Software £11.50 inc VAT

Beyond BASIC

6502 Assembly language on the BBC micro – how to make the most of the 6502 instruction set and write programs to perform arithmetic calculations, use loops and decisions, create lists and tables and perform complex operations on BASIC variables. Includes assembly language routine for graphics and sound.

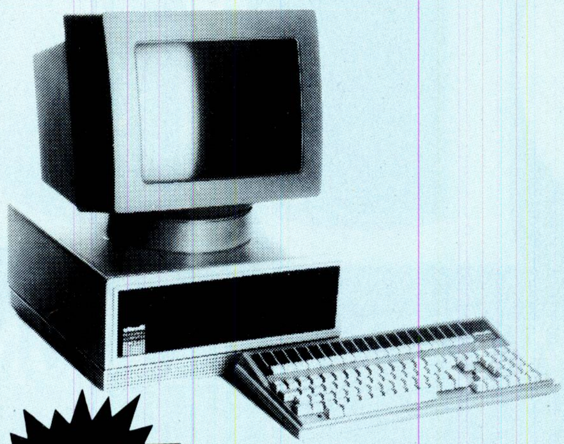
Book £7.50 Software £11.50 inc VAT

Also – 30 hour BASIC, Interfacing and Control Systems, All Fingers Go!, Crossword Puzzler – further details from:

NATIONAL EXTENSION COLLEGE
Dept. BB, 18 Brooklands Avenue, Cambridge CB2 2HN
(prices include post and packing)

INTEREST FREE FINANCE!*

OVER 12 or 24 MONTHS ON THE



e.g.

IBM PC = £1988
÷ 24 (months)
=
£82.83 per month

NEW!

OLIVETTI PC

The totally IBM compatible M24. Full system with 128K – **£1889**

+ IBM PC

The world's leading business computer – **£1988**

OEM

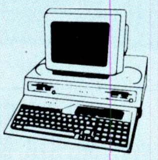
OFFICE EFFICIENCY MACHINES, THE LONDON MICRO CENTRE OFFERS YOU TOTAL FLEXIBILITY AND SUPPORT INCLUDING:–

- **PURCHASE – EX STOCK! **** (volume purchase agreements available)
- **INTEREST FREE CREDIT*** (arranged on most computers over £2000*)
- **RENTALS** (1 day to 2 years)
- **LEASING** (2 years to 6 years)
- **TRADE IN** ANY MICRO against a new machine*
- **ON SITE MAINTENANCE** (contracts also available on equipment purchased elsewhere)
- **BARGAINS** — call for quote on 1 week old showroom models

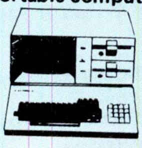
The above also available on most machines including:–

sirius 1

apricot



KAYPRO
Portable computer



Call our West London Showrooms to arrange a demonstration on 01-741 7381

or

To place your order, hot line on 01-748 8404

IBM
IBM Authorised Dealer

olivetti
APPROVED DEALER

APPROVED DEALER

To: OFFICE EFFICIENCY MACHINES LTD.
150–152 King Street, Hammersmith,
London W.6. Tel. 741 7383/4/5/6

Please send me information/quote on:
....

☐ Please ask your sales staff to contact me ☐ Urgent
I have a requirement for ☐ 1 system ☐ 2–9 systems
☐ 10 or more systems
I will be purchasing within
☐ 1 week ☐ 1 month ☐ 3 months or more
My budget is £ ....
Name ______________ Title ______
Company ______________
Address ______________
______________ Postcode ______
Phone ______________ Extension ______

*subject to status and conditions **at the time of going to print.

GOLD

A NEW GENERATION

GOLDSTAR HOME REFERENCE

informative and helpful programs which teach useful, practical skills

With applications to business and professional purposes as well, this is software which will turn your home computer into an invaluable learning resource.

GOLDSTAR ENTERTAINMENT

classic tales of mystery and adventure to challenge your greatest puzzle-solving skills

Imaginatively written and intelligently programmed, this is software which captivates and enchants, and provides hours of creative activity.

TINY TOUCH 'N' GO
cassette version
Dragon 32,
BBC Model B,
Commodore 64,
Acorn Electron

SKETCH PAD
cassette version
BBC Model B/
Acorn Electron

THE GREEDY DWARF
cassette version, BBC Model B, Commodore 64,
ZX Spectrum (48K), Acorn Electron

Clip the coupon for your free catalogue Send to:
Dorling Kindersley Software, 1-2 Henrietta Street, London WC2E 8PS or ring 01-836 6388

Block Capitals Please

Name..........................

Address..........................

....

....

Post Code..........................

PCW

Full supporting documentation in each pack
Available from your nearest computer dealer now

STAR
OF SOFTWARE
GOLDSTAR EDUCATION
teacher-and-pupil tested programs that really aid learning
Developed with education authority programmers, this is software that presents academically sound content in innovative and exciting ways.
GOLDSTAR
THE · CITY · OF 'EHDOLLAH
· A LUST FOR TREASURE · BROUGHT YOU HERE · BUT WILL YOU EVER RETURN?
DON THOMASSON
LEARN ABOUT SHAPES
cassette version for BBC Model B/ Acorn Electron
LEARN ABOUT SHAPES
Fun with Maths and Fred the Flea
ROBIN NORMAN
Ages 7-10
LEARN ABOUT WORDS
cassette version for BBC Model B
GOLDSTAR
LEARN ABOUT WORDS
Spelling Fun with Fred the Flea
ROBIN NORMAN and DAPHNE BELL
Stir
Ark
Pail
Pork
Ages 5-10
THE CITY OF 'EHDOLLAH
cassette version, ZX Spectrum (48K), BBC Model B, Commodore 64
MEGLIN, THE MALEVOLENT WIZARD
calamity which overtook the city killed inhabitants save Meglin, the Keeper of the Sacred Ruby. He had sworn as a young boy to guard the jewel with his life, and created the spells enabling him to forsee the doom that awaited 'EhDollah and what he had to do to survive.
Such strong magic, however, caused him to lose his virtues as a Toggalid, and he adopted the demonic powers of a sorcerer. Where once he contemplated the divine, now all he dreams about is devilry... and the death of anyone who disturbs him. Alone save for the monsters he has conjured up to keep out intruders, he passes his days in the pursuit of evil.
Setting the standard for today's computer user

Mail Order Sales from
Microdeal Mail Order 41 Truro Rd,
St. Austell Cornwall PL25 5JE

Credit Card Sales Access VISA AMERICAN EXPRESS
Phone 0726 3456

Dealers Contact
MICRODEAL DISTRIBUTION
0726-3456
or WEBSTERS SOFTWARE
0483 62222

MICRODEAL

Selected Microdeal Titles available from computer dealers nationwide or from larger branches of

John Menzies Stores and Boots

apple PRICES SLASHED!

Apple IIe

Apple IIe 64k	£450
D/drive w/controller	£240
D/drive without	£190
80 Col Card	£70
80 Col + 64k	£180
Apple 12″ Monitor	£125
Phoenix 12″ Monitor	£90

Macintosh™

INTEREST FREE CREDIT AVAILABLE

WITH FREE MACWRITE
& MACPAINT
£1,795

Lisa 2

CHEAPER AND FASTER

LISA 2
With Macintosh Operating System **£2,625**

LISA 2/5
With 5MB Hard Disk **£3,375**

LISA 2/10
With 10MB Hard Disk **£4,135**

SUBERB GRAPHICS and INTEGRATED SOFTWARE

AND FOR WORK FOR HOME FOR EVERYWHERE IN BETWEEN

NEW

THE APPLE II c

- 128 K RAM AS STANDARD
- BUILT IN 5¼″ DISK DRIVE
- 40 AND 80 COLUMNS
- TRANSPORTABLE — WEIGHS 7lbs
- 2 SERIAL PORTS
- TAKES MOUSE, JOYSTICK, PADDLES
- LIBRARY OF 10,000 PROGRAMS
- 12″ LONG 11¼″ WIDE 2¼″ HIGH

THE TOTAL SOLUTION IN ONE BOX

ONLY £869

For computerised solutions to business problems contact

SIMMONS MAGEE COMPUTERS LTD

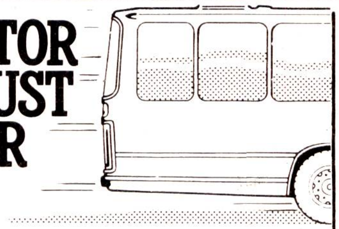
13 YORK STREET, TWICKENHAM, MIDDLESEX TW1 3JZ

01·891·4477 **All prices exclusive of VAT**

Getting the right computer

At the Byteshops we've helped countless companies of all sizes improve their efficiency by the introduction of microcomputers. Generally these are required to perform routine business tasks – but, however similar the application, we invariably find that no two customers have *exactly* the same requirements. When you come to the Byteshop, you'll find that we are far more interested in finding out what jobs you require the computer to do both now and in the future. We then tailor a complete system including not only the hardware but the software, and the peripherals to meet your individual needs. We believe this is the only sensible way to sell computers. Many people talk about providing solutions, but it's often painfully evident that the customers problems only begin with a visit to his/her local computer supplier. We don't subscribe to the view that our role ends when we've made a sale or completed an installation. We're totally committed to after sales service and we're always happy to advise you on all aspects of running your systems. We can even help with staff training for example and provide a range of sensible maintenance plans to ensure your systems keep working. On this spread you'll find a number of "Typical Ready To Run" systems which will serve to give you an idea of comparative costs. However we won't sell one to you – unless you force us – without asking a few questions first!

A COMMUNICATOR SYSTEM WAS JUST THE TICKET FOR NATIONAL BUS



In order to ensure that services accurately reflect the requirements of their travelling customers, the National Bus Company conduct regular market research projects at both national and local levels.
Over the past few years, the processing of the prodigious number of questionnaires generated has gradually moved from mainframe to single user micros. When these reached their capacity limit, however, research head Dr Iain McBrier, saw the need for a system which had at least 5 terminals sharing disk storage and printer. After speed testing the Comart CP520 multi-processing machine, in conjunction with the Byteshop in Birmingham, they had one installed and have been "impressed with its performance." Indeed, they have acquired further Comart systems from Byteshop to handle similar applications in other companies within the NBC Group.

PROGRAMMERS CORNER
Wide selection of programming languages, plus utilities and tools from Microsoft, Digital Research, Microfocus, Xitan and Pulsar, incl. Basic, Fortran, Cobol, Pascal, Assembler, C&PL1.

DISKETTES

Full range of Dysan 5¼", 48 & 96 TPI soft & hard sectored single/double sided & double density diskettes plus 8" IBM 3740 format & PULSAR 3½" Microfloppies stocked. From £1.70 ea. (Normally sold in boxes of 10)

CLEARANCE BARGAINS LONDON

The following are 'one-offs' and available on a first come first served basis.

Qume 955 Daisy Wheel Printer (2348)....................**ONLY 1,800.00**
Qume Cut Sheet Feeder for 955 (595)..........................**ONLY 475.00**
Diablo 630 Cut Sheet Feeder (495)..........................**ONLY 475.00**
Olivetti DY211 Printer (695)..........................**ONLY 550.00**
Tecmar 5Mb Hard Disk Unit (2235)..........................**ONLY 775.00**

microserve

An integral part of the Byteshops, **Microserve** provides a complete range of servicing and maintenance plans nationwide for computers such as the IBM PC and Communicator plus peripherals from Epson, Anadex, Qume, Wyse and Volkercraig. **'Microsure'** – our speedy nationwide on site maintenance contract for a 'once only' annual fee. **'Microswap'** – component exchange service. **'Micromend'** – workshop repair and up grades. **'Microcall'** – on site maintenance and repair charged on a time and materials basis. **'Microtrain'** – runs product training courses for your own service engineers. Call into your local Byteshop for further details or 'phone **0480 215005** for a Microserve Information Pack.

At a glance Computer Checklist

	BBC Model B	Act Apricot	IBM PC/XT	Comart Communicator
Colour graphics	•		•	
Multi-user				•
Hard disk storage		•	•	•
Upgradeable				•
Expandable			•	•
Communications	•	•	•	•
Transportable	•	•		
Networking	•		•	•

THE BYTE SHOPS-W ON GETTING THE R

COMART COMMUNICATOR

Exciting news is the arrival of 16 bit single and multi-user Communicator Systems incorporating Digital Research's very latest operating system – Concurrent CP/M. This allows full multi-tasking facilities for up to four different functions supporting up to 8 work stations. You'll also find that Communicators are competitive with the best desk tops as a single-user system, are perfect for companies planning to expand and for multi-users, nothing compares. And the Communicator's modularity means you can add-in extra capacity and add-on storage back-up units to keep pace with your future needs.

COMMUNICATOR SMALL BUSINESS PACK

Communicator CP200 8 bit 64Kb RAM 2 × 790Kb Floppy Disk Drives, WY50 Keyboard/Display 101 key, 14" Green Screen, the Brother HR15 Daisy Wheel Printer (£455) inc. Cables and Diskettes plus CP/M WORDSTAR, WP WORKSHOP, SUPERCALC, FRIDAY & XBASIC for the complete office system ....**2950.00** ex. VAT

COMMUNICATOR HIGH CAPACITY 16-BIT SYSTEM

Communicator CP1542 16 bit 8086 processor, 256 Kb RAM, 1 × 790 Kb floppy disk drive plus 1 × 40 Mb hard disk drive inc. concurrent CCP/M86 version 3.1 multi-tasking system software..............................**4,995.00**

5-USER COMMUNICATOR MULTI-PROCESSING/ MULTI-USER SYSTEM

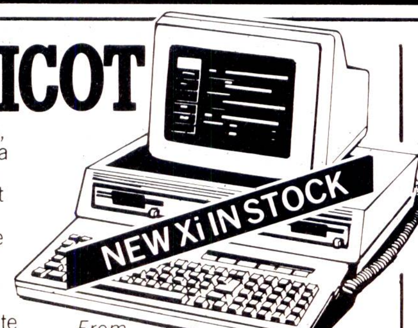
COMPLETE SYSTEM FROM £1800 PER USER*

This allows each user to have their own dedicated Z80A processor and 64K b of memory while sharing printer facilities and data from common disk storage. So two users, for example, could be running word processing, one accessing databases, one updating a sales ledger, while the fifth is preparing budgets using a financial planning package.

Communicator CP520 MP 5-user Multi-Processing System ....**5995.00** ex. VAT

* To include 5 × WY50 Display Terminals and all cables...........**9,095.00** ex. VAT

ACT APRICOT



Already an outstanding success, the transportable Apricot offers a comprehensive specification at very low cost, making it a perfect solution for the small businessman. Noteworthy is the 'Microscreen', a two line LCD display with six associated keys on the main keyboard. The Microscreen can display day, date and time; double as a calculator; provide labelling selection; serve as an information entry line or act as a display window when a full monitor is not available. Other features include a 'mouse trap', 256K b memory expandable to 768K b and Sony 3.5" disk drives offering 315K b of storage each. Included in the price are three operating systems MS/DOS 2.0, CP/M-86+, Concurrent CP/M-86 together with Microsoft and Personal BASIC, Supercalc, Superplanner and Asynchronous File Transfer Software.*

From **1495.00** *ex. VAT*

1495.00 ex. VAT
1890.00 c/w twin disk drives & monitor ex. VAT
2695.00 c/w 5Mb hard disk & 315Kb floppy disk drives & monitor ex. VAT.
2995.00 c/w 10Mb hard disk & 315Kb floppy disk drives & monitor ex. VAT.

* Subject to availability

APRICOT BUSINESS SYSTEMS

Financial Planning
Apricot c/w Dual Disk Drives & Monitor with SUPERCALC plus upgrade to SUPERCALC 2 together with Epson FX100 160 CPS Dot Matrix Printer (£569)...........**2595.00** ex. VAT

Word Processing
Apricot c/w Dual Disk Drives & Monitor, with WORDSTAR Word processing and Spelling Checker plus Epson RX 80T–100 CPS – Dot Matrix Printer (£279) for fast drafts and Brother HR15 letter quality Daisy Wheel Printer (£455) ....**3075.00** ex. VAT

Database Management
Apricot xi c/w 5 Mb Hard Disk & 315Kb Floppy Disk Drives & Monitor with DBASE II plus Epson FX80 160 CPS Dot Matrix Printer (£438) ....**3565.00** ex. VAT

Small Business Accounts System
Apricot xi c/w 10 Mb Hard Disk & 315 Kb Floppy Disk Drives & Monitor plus PULSAR Sales, Purchase, Nominal Ledgers and Invoicing plus Epson FX100 fast Dot Matrix Printer (£569) ....**4385.00** ex. VAT

FREE Systems Implementation Course with every Apricot System purchased when you enrol for training at ACT Training Centres.

New from Casio that fit your

Two new portable micros from Casio. The **PB700** and the **FP200**. Both sophisticated, reliable and compact.

Casio have a worldwide reputation for high quality workmanship, coupled with value for money prices; it's a reputation that was first established in the calculator

The PB700

● Powerful pocket micro with extensive graphic capabilities and the potential for system expandability.

Memory

● **4K RAM** expandable to **16K** with **OR4, 4K RAM** modules.
● **25K ROM.**
● 20 character x 4 line display with 160 x 32 dot graphics.
● FOR-NEXT loops to 6 levels, 12 levels of sub-routines.
● Power source: 4AA size batteries plus lithium cell for **RAM** back-up.
● Complete with "Easy Trip to Basic" instruction book and quick reference guide.

Optional Accessories

● **FA10** — with 4 colour 115mm wide paper plotter, external cassette with interface; cassette remote control; mains adaptor.
● **FA4** — with centronics standard, 8 bit parallel interface; external cassette interface; cassette remote control; mains adaptor (optional).
● **CM1 — built-in micro cassette module (optional).**
● **OR4 — 4K RAM** modules.

The FP200

● Compact portable computer with versatile spreadsheet programme, based on Casio's Easy Table Language (CETL).
● Programmable in BASIC and CETL.

Memory

● **8K RAM** expandable up to **32K RAM** with **FP201, 8K RAM** modules.
● **32K ROM** expandable to **40K** with **FP205 8K ROM** module.
● 20 character x 8 line display with 160 x 64 dot graphics.

CASIO

-mighty micros briefcase

market, moved into watches and electronic musical keyboards and is now advancing into the world of micro computers.

Advanced technology. Painstaking quality control. Modern design. They all play their part.

Just some of the reasons why you should check out the new Casio portable micros.

The Casio Portable Micros

The two new portable micros featured here, both offer that famous Casio reliability. They both offer the user a compact micro, that is already supported by a range of programmes from some of the U.K.'s leading software houses, as well as Casio themselves.

And Casio micros are designed to grow with your needs. You can add to the memory, and there is a range of options available.

There's also Casio's comprehensive range of instruction books to help you get the most from your micro. So however fast you expand, Casio will help you keep pace.

- Typewriter standard, QWERTY keyboard.
- 3 extensive instruction and reference manuals.
- Centronics parallel, **RS232** serial and cassette interface built in.
- Power source: 4AA size batteries with 2 AA size for memory back-up.
- Dimensions — 310mm x 270mm x 55.5mm.

Optional Accessories:

- **FP1011PL** — 4 colour printer plotter.
  AD4180 — mains adaptor.
  FP201 — 8K RAM.
  FP205 — 8K ROM.

MAGIC!®

Casio approved software available from:

Kuma Computers Limited. Telephone No. Pangbourne (07357) 4335.
Micros for Managers. Telephone No. 01-370 5125.
Casio Electronics Company Limited. Telephone No. 01-450 9131.

For further information please write to: Mr A Manton, Product Manager Computers, Casio Electronics Co Ltd, Unit 6, 1000 North Circular Road, London NW2 7JD.

Please send complete details on PB700/FP200*

NAME ______ (BLOCK CAPITALS)

COMPANY ______

ADDRESS ______

______

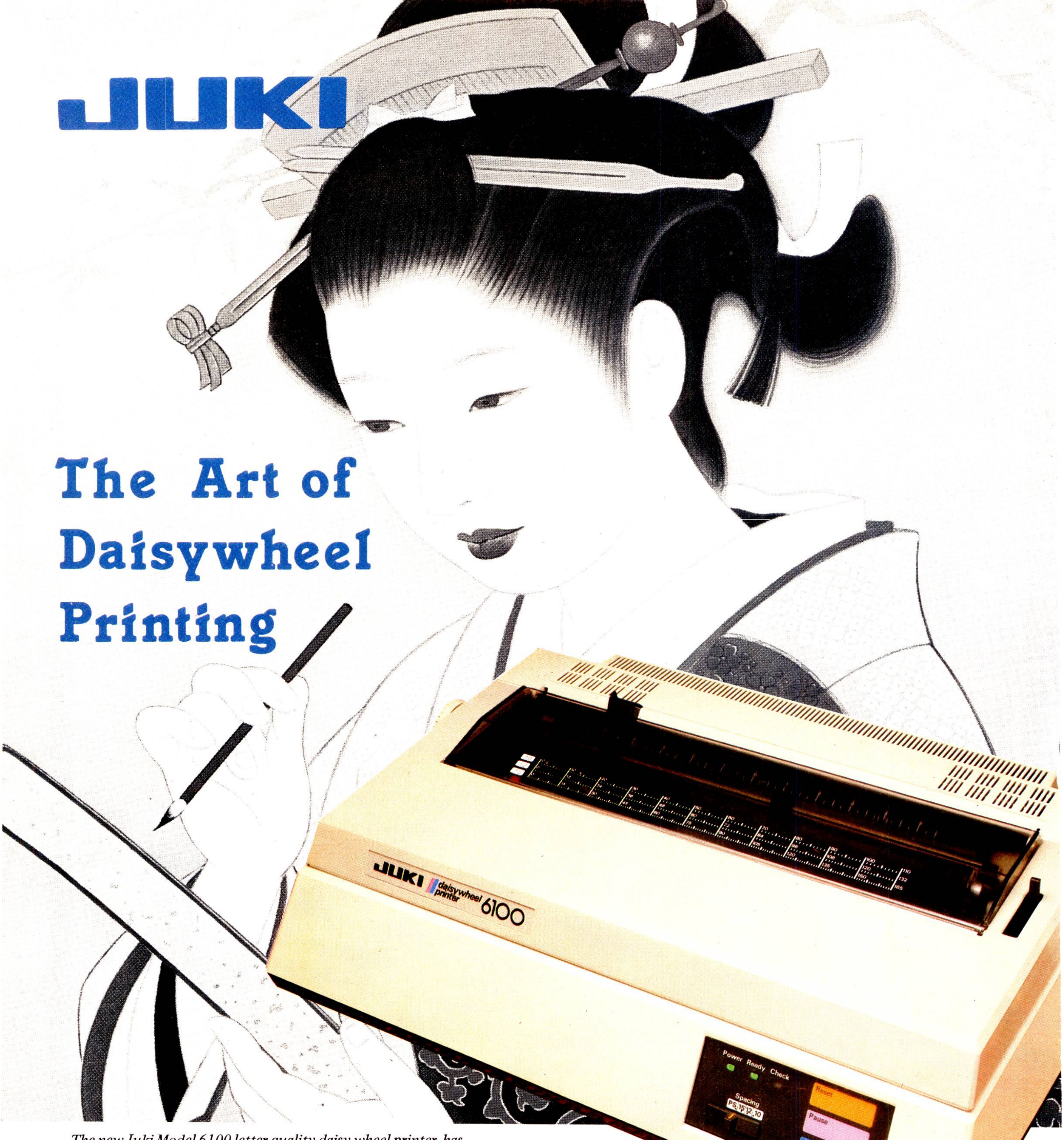
POST CODE ______ TEL. NO. ______ AGE ______

*Delete as applicable.

Dealer Enquiry Yes/No

JUKI

The Art of Daisywheel Printing



The new Juki Model 6100 letter quality daisy wheel printer, has full features you'd expect to find on a more expensive printer.

It can support word processing and graphic functions, print 20 CPS and use a simple drop-in daisy wheel.

The 6100 has 10/12/15 pitch, proportional spacing, utilizes IBM standard Selectric ribbons, has 2K buffer memory, parallel interface both tractor feed and serial interface are available as options.

That's only the beginning – Best of all, the low-noise Juki 6100 is extremely reliable.

Your can pay more, but you can't buy better than the Juki 6100.

FEATURES:

*20 CPS (max.) print speed *Bold and shadow printing *Subscripts and superscripts *Wordstar compatible *Diablo protocols *Auto Underlining *Standard 2K buffer *1year parts and labour warranty *Comprehensive user friendly manual

mp Micro Peripherals ltd

'THE POWER BEHIND THE PRINTED WORD'

69 The Street, Basing, Basingstoke, Hampshire RG24 0BY
Telephone: 0256 3232 (12 lines) Telex: 859669 MICROP G

Call your local dealer NOW for full information on the Juki 6100 Daisywheel Printer or clip this coupon and we'll send you brochures and print samples.

Name..

Address..

....

.... Tel. No.............................

Sullivan's

microcomputers

Sullivan's, due to its well established position in computer servicing, is able to offer comprehensive maintenance contracts on microcomputer systems for

FIVE PER CENT

of the cost of the system per year

NATIONWIDE

Very few can make this offer – Sullivan's can.

This cost is for a fully comprehensive contract for your microcomputer system, including parts, labour, and travelling, with a twenty-four hour response and fix time, (or down to four hours for corporate customers at the same cost), and two preventive maintenance visits during the year. Sullivan's deal with corporate companies, medium sized companies, institutions, small companies. Those with one system upwards.

We are not microcomputer dealers, (though we do support their clients), we are a service company, and therefore clients receive our best attention for their problems. This cover provides more than an insurance policy – an insurance policy will not provide for replacement units or routine maintenance visits. Is it worth going anywhere else? We look after for example, **Apple, Commodore, IBM PC, ACT Sirius, ACT Apricot, ICL Micro, Epson, Anadex, Qume printers, hard disks, Kaga, Sharp, Zenith monitors.** Unusual makes are also covered, don't hesitate to telephone. Sullivan's – making quality maintenance services available to more and more computer users every day. Be safe – go to Sullivan's.

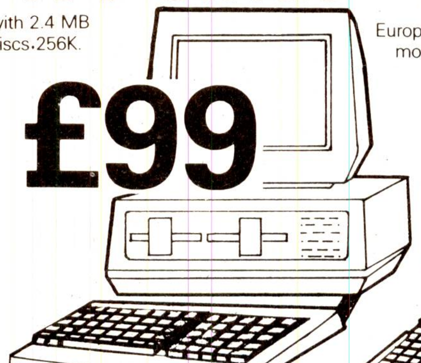
IBM PC

with two disc drives, monitor, keyboard, and IBM Matrix printer.

£121

ACT Sirius

with 2.4 MB discs.256K.



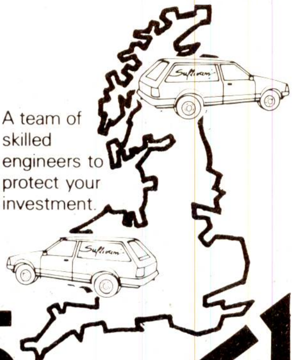
£99

Apple II

Europlus or E with two disc drives and monitor, with matrix printer.

£145

A team of skilled engineers to protect your investment.



Phone now on our central number 01-431 0320 for cover in England, Scotland and Wales, or clip the coupon. A two year contract is also available, at 20% less than double the cost. Systems that are in manufacturers warranty can be covered at lower cost, for example, on IBM equipment, we cover at a nominal ½% during the six month warranty and then at 2½% for the next six months, making a contract cost of 3%.

We are happy to offer our services to dealers, providing nationwide hardware support for your clients. We welcome dealers enquiries.

HOTLINE 01-431 0320

Clip the coupon here.

I would like to know more about how Sullivan's service can benefit my company.

Sullivan's **FREEPOST**
4 Marty's Yard, Hampstead, London NW3 1QW

Name

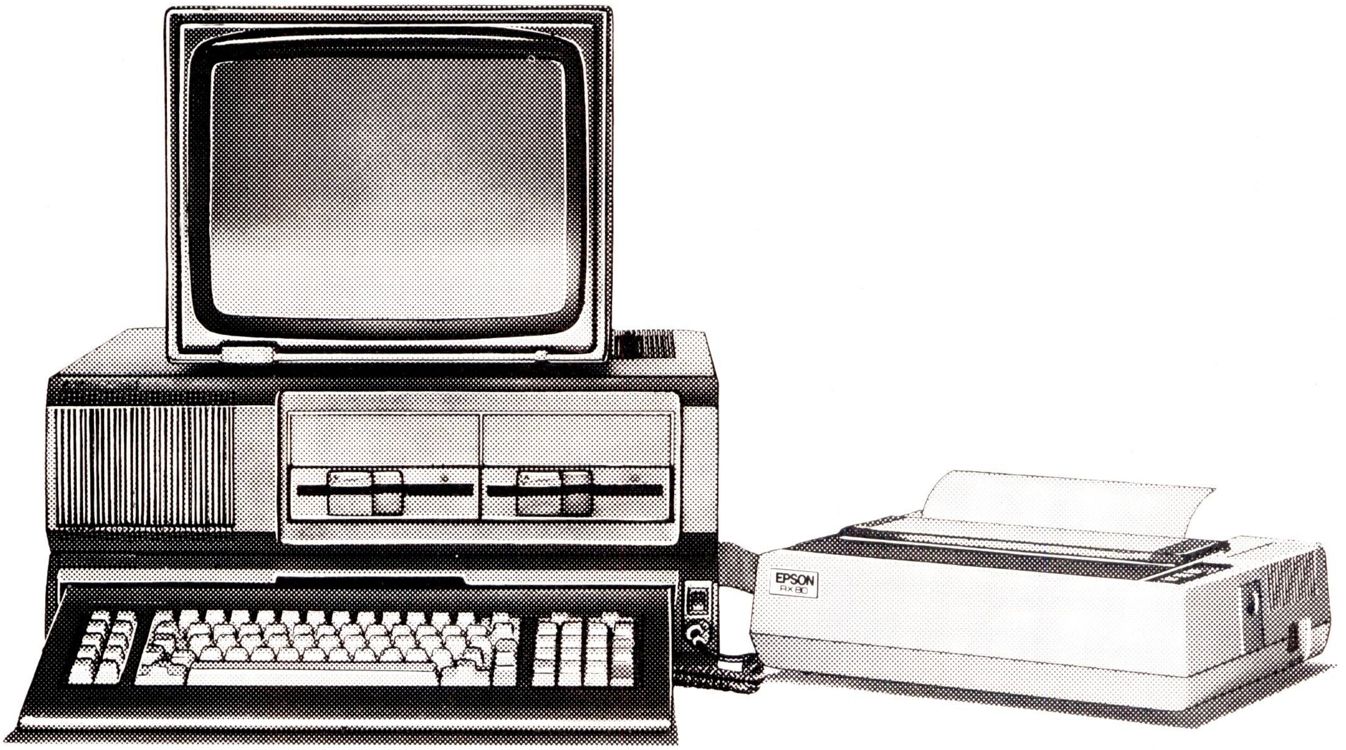
Position

Company

Address

Tel:

Why you should buy a computer you've never heard of, when you know you want an IBM PC.



Advance 86b specification. Intel 8086 CPU. MS DOS operating system. Twin-disk drives. 128K RAM expandable to 640K. Interfaces for light pen, printer/plotter, joystick, monitor and RS232C. Capacity for 4 expansion boards, plus a further 2 true 16 bit slots. Graphics – 16 colours, 80/40 columns x 25 row text, 640 x 200 pixels. Package illustrated Epson RX80 F/T Printer (£325 inc. VAT) and Microvitex monitor (£249 inc. VAT).

* Excluding N. Ireland. Subject to availability. Prices correct at time of going to press.

Sullivan's
microcomputers

Sullivan's, due to its well established position in computer servicing, is able to offer comprehensive maintenance contracts on microcomputer systems for

FIVE PER CENT

of the cost of the system per year

NATIONWIDE

Very few can make this offer – Sullivan's can.

This cost is for a fully comprehensive contract for your microcomputer system, including parts, labour, and travelling, with a twenty-four hour response and fix time, (or down to four hours for corporate customers at the same cost), and two preventive maintenance visits during the year. Sullivan's deal with corporate companies, medium sized companies, institutions, small companies. Those with one system upwards.

We are not microcomputer dealers, (though we do support their clients), we are a service company, and therefore clients receive our best attention for their problems. This cover provides more than an insurance policy – an insurance policy will not provide for replacement units or routine maintenance visits. Is it worth going anywhere else? We look after for example, **Apple, Commodore, IBM PC, ACT Sirius, ACT Apricot, ICL Micro, Epson, Anadex, Qume printers, hard disks, Kaga, Sharp, Zenith monitors.** Unusual makes are also covered, don't hesitate to telephone. Sullivan's – making quality maintenance services available to more and more computer users every day. Be safe – go to Sullivan's.

IBM PC

with two disc drives, monitor, keyboard, and IBM Matrix printer.

£121

ACT Sirius

with 2.4 MB discs. 256K.

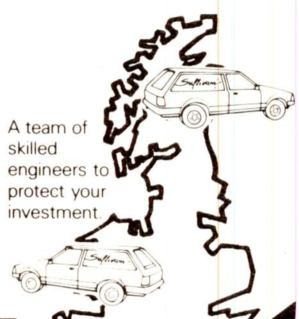
£99

Apple II

Europlus or E with two disc drives and monitor, with matrix printer.

£145

A team of skilled engineers to protect your investment.



Phone now on our central number 01-431 0320 for cover in England, Scotland and Wales, or clip the coupon. A two year contract is also available, at 20% less than double the cost. Systems that are in manufacturers warranty can be covered at lower cost, for example, on IBM equipment, we cover at a nominal ½% during the six month warranty and then at 2½% for the next six months, making a contract cost of 3%.

We are happy to offer our services to dealers, providing nationwide hardware support for your clients. We welcome dealers enquiries.

HOTLINE 01-431 0320

Clip the coupon here.

I would like to know more about how Sullivan's service can benefit my company

Sullivan's **FREEPOST**
4 Marty's Yard, Hampstead, London NW3 1QW

Name
Position
Company
Address
Tel.

GAMER

NEW SHOP NOW OPEN AT 71 EAST STREET BRIGHTON

Tel: 0273 728681

Wide range of Home computers plus Epson, PX-8, HX-20, QX-10, Sanyo 555, Wren, Kaypro, Xtra.

WANTED!

Got a good program? Come to the experts

We are looking for original software titles for National and International Distribution for the following Machines:

Any Atari Home Computer
Sinclair Spectrum/QL
BBC 'B'/Acorn Electron
Commodore

We are also interested to hear from capable freelance programmers.

Please contact in writing only:

Jon Dean
Software Acquisition Centre (PCW)
Atari International (U.K.) Inc
Atari House, Railway Terrace
Slough, Berks SL2 5LS

ATARI®
A Warner Communication Company

SOFTWARE FROM FLITE:

CARTESIAN

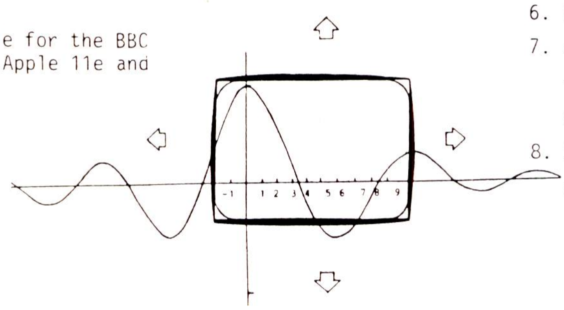
can graph the simplest of functions

Or the most complicated. It then goes on to do an awful lot more. Like drawing the differential curve and finding the definite integral. Like extracting roots wherever they exist, even when the function has multiple roots. Like solving complex equations. Like allowing for many graphs to be overlaid one on the other. Like letting the user animate the scales and axes in order to reach any part of the curve, and to magnify segments.

Naturally if CARTESIAN can handle the functions above, then it can also take care of quadratics, cubics, trig. functions, polynomials, circles and elipses.

CARTESIAN is available for the BBC 'B', Acorn Electron, Apple 11e and Apple Europlus.

PRICE:
Cassette: £24.90
Disc: £27.75



Cartesian is fun to use, which should go a long way towards ensuring that it *is* used, and it is both powerful and flexible enough to be of real benefit to any serious student of mathematics.

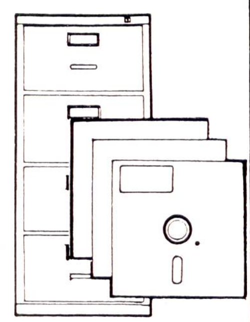
-Hobby Electronics

FILE BASE

YOUR BBC OR ELECTRON DISC DRIVE NOW HAS A WORTHY CARD INDEX DATABASE AT AN EVEN WORTHIER PRICE.

Use it in the home, club, office or school. It's very versatile.

1. Records are designed by the user
2. May be used with one disc drive.
3. Allows selective label/envelope addressing or full record recall.
4. Search using ANY field.
5. Random access for fast operation.
6. Very user friendly.
7. 40 or 80 track versions. A 40 track disc will hold up to 400 records depending on size.
8. Sort, amend, recall, print-supports professional standard features.



price:£15.90

Disc only. Please specify whether 40 or 80 track.

ACCESS, Barclaycard(VISA) and official orders welcome.

FLITE software

Findrum, Convoy, Co. Donegal
Ireland. Telephone (074) 47227
Mail Order (074) 22286 & (074) 22025

Guy Kewney discovers a word processor that will correct spelling mistakes and looks at a company that continues to make programs and money despite the threat of piracy. Oh, and what's Alladin doing on these pages . . .?

Spot the mistake

Has it ever struck you as odd that your computer will *let* you type PRUNT, instead of PRINT, when you are composing a Basic statement? Or that a Pascal editor is very happy to see you type wrireln instead of writeln?

People with the Spellbinder word processor program can now train it to catch this sort of error. Richard Barber of Tonsor has devised program development macros for several languages.

The languages start with BBC Basic, CBasic, MBasic, and include Pascal, 'C' and BCPL, Ada, and PL/I. And one which you mightn't expect: dBase II.

The nice thing, says Barber, is that the word processor doesn't just recognise keywords. It also understands the layout of the language on screen, and will give it a nice structure.

As with Sinclair ZX Basics, the keyword entry saves typing. Also, as with ZX Basics, there is more pressure on you to use the right structure. Spellbinder also provides enormously more powerful editing facilities than ordinary Basic editors.

The drawback is that Spellbinder needs a CP/M or IBM family micro, and is not an operating system nor an interpreter. So having typed a few lines of code, you can't check them out instantly by typing RUN — especially if your target machine is a BBC Micro with a 6502 chip in it.

Details on (0932) 220661.

If we had a way of printing this picture clearly enough for it to be read, you would notice that the letters are all capitals.

That is because people use telex which can't transmit lower-case letters. And because telex is both fearfully expensive and clumsy to use, it is worth spending £3000 on this Systell-X telex preparation system for a Fortune micro.

What I want is for somebody to agree a simple protocol which will not affect telex machines, but which will let computers tell each other that they have switched from upper to lower case.

Something simple could be done — for example, transmitting 'Numbers' then 'Letters' again before any numbers are sent.

Better yet, let the telecommunications authorities of the world set up an international electronic mail service, so that we can abandon the dinosaur telex this century, rather than half way into the next.

Systell-X is contactable through IBR Microcomputers on (0734) 664111.

Foxy networking package

Yet another network product shows that the American assumption that: 'People will be using IBM PCs' when they design products is assuming frightening importance.

Fox Research's '10-Net' is a very cheap way of adding a network to your IBM — assuming that other people in the building comply and also have IBMs.

Networks will, one day, be the answer to the problem of people who want their own computers on their desks, and also want to share data with their colleagues. But first the networks have to be universal, and they have to be cheap.

This one is cheaper than other nets which use variations of the Ethernet blueprint, because instead of the pricey co-axial cable, it uses a simple twisted pair of wires. But it does use Ethernet protocols, so it should be possible to connect a family of 10-net micros to a family of Ethernetted machines without re-writing the code.

The answer to making a network universal, however, is less obvious. Fox has assumed that the PC hardware provides one likely standard. However, the other side of the assumption that everybody in the building has a PC (yes, possible) is that all of them buy 10-Net (no, not so likely).

So, in addition Fox has launched useful software in the form of a multi-computer database, to run on the net.

The database is called 10-base, and will appear familiar to any professional IBM mainframe user who has met Sequel (SQL).

More importantly, multi-user programs can be written with 10-Base working over the network.

A network of PCs with 10-Base and 10-Net will still (today) be a lot more costly than a multi-user microsystem with Unix, simply because the price of the PCs will be so much higher than the dumb terminals on the Unix system.

But with a good (cheap) imitation IBM, this sort of network could look like quite a powerful alternative, one day.

Fox is in Ohio on (513) 433 2288, at 7005 Corporate Way, Dayton, Ohio 45459.

Micro patrol

Users of Prestel who get news and software from Micronet will notice that their favourite electronic newspaper has a new cover.

It looks, for all the world, as though it has been taken over by Prestel itself.

Behind the front cover, things haven't (yet) changed much. Micronet still provides the services for its subscribers. Software is still available and news is published.

Soon, however, things will change.

For a start, all microcomputing people are to be pulled into one little area of Prestel, known as Prestel Microcomputing.

This will include absolutely anybody who wants to transmit software to Prestel users. That is, Viewfax 258,

This is a Sony viewdata terminal, for any complacent people who thought that microcomputers had taken over.

Did you realise that Sony reckons to be 'market leader in viewdata terminal sales' and that the Sony viewdata terminal, which has to have computing power inside it, cannot be used for anything other than looking at Prestel-style pages?

Prestel has actually chosen this dumb beast as the basis of the Farmlink service, and our photographic models are farmer Robin Leaney (left) with his son Duncan, 'checking the weather report on a Sony KTX1400 terminal.'

'Arr, Duncan lad, the capacitors do be smelling a bit grimy today, arr, that do be a sure sign of gales, my ol' Dad he used to say...'

Micronet 800, and many others still to make their appearance.

The main reason, officially, is to encourage standards.

In fact, there is commercial pressure on Prestel from two directions. First, Micronet has been paying Prestel an enormous royalty on page accesses. Nobody will say exactly how much it is, but I know that over a third of Micronet revenue, received from micro users, has been going straight to Prestel.

Second, having provided 8000 or so microcomputer owners to boost the numbers of Prestel users, Micronet feels a little aggrieved to find that other micro software suppliers have been able to provide the same service without charging the £32 extra 'closed user group' or CUG fee.

What, it says, really worried everybody was the appearance of a number of rogue users operating under other people's identities.

These shameless scoundrels would crash the system, download software from several sources and disappear. And Prestel would have to wait for the long, slow process of collecting records from independent information providers, before it could say with certainty which ID was being used by the hackers.

Now, however, all microcomputer software will be provided through the one CUB. So anybody prowling around will become far more quickly visible to the micro patrol.

My own suspicions, however, are that Micronet has been failing to pack them in the way it was meant to. 'Meant to' is a technical phrase, referring to the levels of users agreed by Prestel when it originally signed a deal to subsidise Micronet. No increase in user numbers, says the deal, means no more subsidy.

Bob Denton, who was once managing director of Prism (a part owner of Micronet) and was on the board of Micronet itself, has resigned after moving a vote of no confidence in the board of Micronet.

He interprets the move as 'essentially a loss of franchise' for Micronet. And he has been moved to suggest that the Wren, the portable computer Prism was going to offer as part of a 'business Micronet' service, may have to look elsewhere for its business network.

Software by post

It is a month too late for the news that MRM Software is available through the post to be news.

Nonetheless, it is good news for British software — not because MRM writes the best software in the world, but because it got into business at all. Unlike any other software company, when it started, it had no way of duplicating its programs.

The company actually started as an advertiser on Micronet 800, offering a program called Q-Man.

It was fun. Written in BBC Basic, it got high sales, purely to Micronet users.

However, at that time, the established software companies were scornful in their dismissal of Micronet as a distribution medium.

They still are. 'You can't expect us to put out valuable programs onto a network where they can't even guarantee to monitor the number of sales accurately,' they say. 'And programs on Micronet are just asking to be ripped off.'

Quite possibly, yes. I have heard of one enterprising school student who bought programs off Micronet, then copied them and sold them at £2 a time to her simple-minded friends.

Nonetheless, the facts are the facts: they are, that the directors of MRM have expanded their business to the point where they are no longer just three kids on the dole in Grimsby, but can afford to send duplicated tapes through the post to a wider audience than those few thousand Micronet users.

The lesson is that you can spend your life being paranoid about copying, or you can get on with writing programs and selling them. And I know which will give the better return.

MRM software is on (0472) 44304. Its games include Banana Man, Guy in the Hat, Secret Sam (two adventure games) and 3D Munchy, as well as Q-Man and Q-Man's Brother. They cost £4.95 plus 55p handling per order and run on a 32k BBC Micro.

High expectations

Top marks for over-cooking enthusiasm this month go to EMAP International Exhibitions, which is organising a little show in September on behalf of its paper *IBM Sytem User*. EMAP told me of a list of a whole 26 people who are going to exhibit. On the list were at least three EMAP or related companies. And it would be ill-natured of me to draw attention to the trivial omission of a company called IBM from that list.

No, it's the positive thinking of it all that appealed to me.

The announcement was sent with the heading: 'IBM System User Show Poised' (lovely word, poised) 'To Become The Biggest Event In Europe.'

I'm sure that once the company realises that *IBM System User* itself is exhibiting, the IBM lords in Basingstoke and Havant will acknowledge the necessity of moving in with all their

It looks like a smart executive office, but the hope is that 'TSquare will be to the draughtsman what the word processor has become to the typist.'

It is a draughting aid and costs £16,000, including an IBM micro with hard disk (the IBM XT) and still lacks a plotter.

Bill White, marketing director of Norrie Hill, the company which produces it, says that: 'It has been developed to provide a professional draughting system without the sophisticated features associated with computer-aided design.'

In other words, it is a lot more than a graphics tablet. It can produce professional drawings with blueprint-type labelling. But it can't be used to produce the instructions required to build the end-product — it is merely a draughting tool for a professional.

Details on (0276) 681655.

products from mainframe systems to micros, as this passionate announcement so eloquently phrases it.

One can glean a touch of ironic amusement from studying the other show for IBM users — the PC User Show, organised by the same company. IBM is exhibiting at that one. Only the PC, true . . .

Apricot still not ripe

I'm pleased to be able to update a report of a few months ago that the Apricot was still a bit slow.

As an experiment, I have typed out this month's column on an Apricot, and will concede without grudging that it now runs the WordStar program, both under MS-DOS and under CP/M or Concurrent-DOS, as fast as one might wish.

That's the good news. I'm not able to report equally good news about sales. Encouraging reports about sales from ACT are not borne out by conversations with dealers, who estimate that less than half the people who had been expected to buy the Apricot have actually done so.

There are two reasons for this.

Firstly, IBM fever has at last started to affect our bigger companies, who are looking greedily at US computer software and finding that they can't run it on MS-DOS machines.

Companies like Future Technology have excellent MS-DOS machines, which can run Concurrent-DOS, even to the point where I've seen Lotus 1-2-3 loaded on one from the IBM diskette and apparently running without hitch.

But the PC mode of Concurrent-DOS is still not available from all the plug compatibles, and even on the IBM was only expected to start shipping to dealers in late May.

Until that is available, dealers will not know whether or not they can sell rivals to the IBM as 'of course this can run IBM software, and what is more, you can run two IBM PC-DOS programs simultaneously . . .' and so the customers won't know either.

Either way, it doesn't help the Apricot, which has 3.5in Sony diskettes and couldn't load IBM software even if it could run it.

Worse, dealers are not able to get enough Sony diskettes.

Statistics aren't available from Sony, but the street says that a million diskettes are made each month, and each month, two million diskettes are bought. Stocks are running down, and big speculators in Canada (why Canada?) are reported to have cornered vast supplies of disks, and are waiting for the price to rise.

This affects Apple, too.

Both Macintosh ('Mac') and Lisa 2 use Sony drives and diskettes, and while they are magnetically different from the ones on the Apricot and Hewlett Packard micros, they are physically from the same factory. That is to say, when Mac becomes available next month after delays caused by factory hiccups, buyers will be told 'Only one box per machine'.

A box of diskettes may cost a fortune, but it doesn't hold many diskettes — 10, in fact. I know of one dealer who actually bought a Lisa in order to get extra diskettes for his Mac.

Once Mac is in the market, the shortage of diskettes will be worse, probably. But there is a strange possibility that this will help the Apricot, because certainly some people are holding off the Apricot until they see Mac.

There isn't much doubt that people who see Mac will want it. On the other hand, it is still very short of the software it will have in a year's time, but which is still in final development in a hundred and one software houses. And it will be short of diskettes, too — trivial, perhaps, but crucial.

So, I suspect that the Apricot, for which there is now a reasonable body of software ready (even if not Lotus 1-2-3) will actually do better once its more glamorous competitor starts to appear. And around then, the double-sided diskette Apricot will be starting to sell, too, and the hard disk version, making it an expandable proposition. That will help.

But even so, I'm not sure that it will make the 50,000 sales this year which ACT hoped for it.

Deliberate strategy

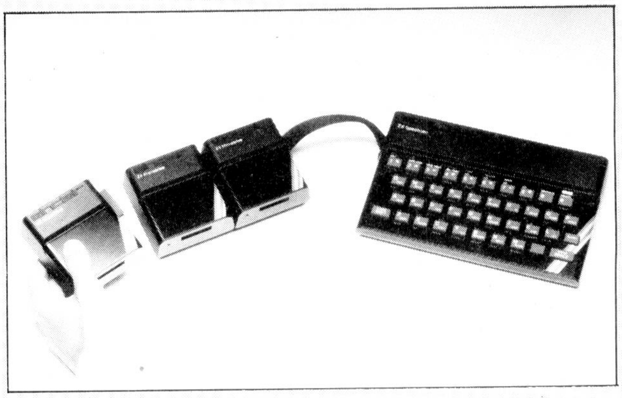
The shortage of IBM computers is one which many people are saying is artifically created by IBM.

The company tells tales of 'large stocks' in Scotland, and of the fact that IBM's own retail centres seem to have ample supplies, while independent dealers are running painfully short.

What is known for certain is pitifully little. It is certain that IBM did announce a rationing system, limiting trade buyers to 25 machines a month.

Trade buyers who sold 10 a month expressed themselves well pleased with this arrangement.

Larger people who can sell up to 200 a month made less enthusiastic noises, and IBM hastily re-arranged its plans,



Those amateurs who have been doing a flourishing trade in order forms for Mirodrives should, finally, have been laid to rest by the arrival of Sinclair's tape-loop storage device in shops.

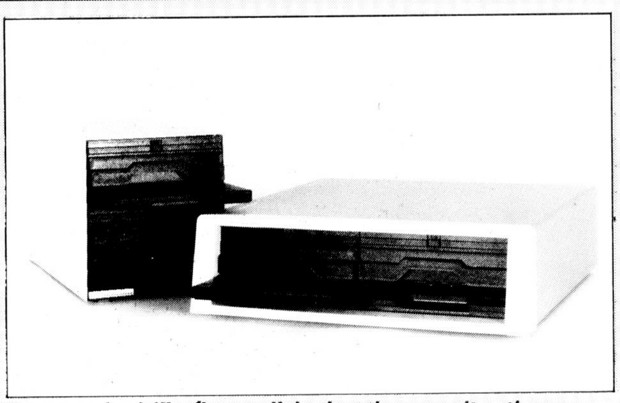
More importantly, the arrival of large numbers of Interface 1 units from Sinclair means that users can start planning networks, modem purchases, and other things that require a standard serial link.

The actual tape loops, however, remain an enigma. They are quicker for program SAVE operations than tape, and more reliable than many people's tape players.

But at £5 for a single tape cartridge, not many schoolkids will be collecting a huge library of them or swapping them around happily with each other. And software costing £5 on cassette will cost £10 on this, so software houses won't rush to buy the cartridges, either.

Sinclair refuses to be drawn on the final price of cartridges. Production experts say that, theoretically, one day, if there is enough demand, then it could come down as low as 50p.

But if it doesn't come down to 50p first, then the demand will never be there.



They may look like floppy disks, but they aren't — they are fixed hard disks with supplementary removable hard disks.

That means that when the fixed hard disk needs copying onto a library file system, you copy it very quickly onto the removable hard disk.

The device, called the Alpha 10, comes from APS Microsystems and provides either 20Mbytes or 10Mbytes in a box.

What I find just a little bothering is APS's claim that: 'The style and box colour is a perfect match' to the IBM PC. And equally troublesome to one's sense of what is right is its claim that: 'The system is widely considered to be the major software innovation of the decade'.

Ring the company on (0273) 420195 and ask what the hardware looks like.

offering an allocation 'based on historical ordering patterns.'

At that point, hard information runs dry. An IBM executive responsible for public statements to the press assured me that 'the situation is a bit confused.'

Stocks of IBM personal computers in IBM retail centres are rather easier to explain, but not for IBM. With one voice, independent dealers explain it as follows: 'The turkeys who work in the centres can't sell computers, so naturally they have lots of stocks.'

The other side of the coin is that IBM does like to keep its discounts in-house. Rumours are that the internal sales force is anxious to emulate rival ICL by selling large numbers of machines to big companies, collecting healthy commission payments. It doesn't like to see dealers selling to these big, multiple-order customers.

Whether IBM would actually increase stocks for its internal sales force and reduce them for external dealers can only be left to the imagination.

Husky printer on the go

Britain's oldest lap-held portable, the Husky, now has a printer to go with it. The Husky Reporter has its own battery, and has a little 'cradle' for the Husky Hunter computer. This 'makes it ideal for use in financial related applications such as van sales,' says the company.

The printer is good for about 5000 lines of print, and can print carbon copies, too (up to three copies), because it uses an impact method.

Details on Coventry (0203) 668181.

The one-handed typewriter, the Microwriter, is now available for a very realistic price, with a printer, as a 'word processor'.

The package which Cy Endfield's company has wrapped up for the latest product includes a Smith Corona daisywheel printer for a total of £490. This is, at last, a reasonable price, and makes the system recommendable despite its remaining drawback — the tiny Microwriter display.

That problem, however, is being fixed. Not by the production of the Microwriter with a Tandy 100-type display, though that is being considered too, but by the discovery of a way of selling naked micro keyboards for plugging into other computers.

The system will really catch on when Endfield interfaces it to things like the Tandy, where you can go crazy trying to hold the thing in one hand while typing with the other. A one-handed entry system would make it indispensable.

Details on (01) 836 6801.

Hoist by its own petard

Telecom has been caught in its own trap, and is having to get the law changed to permit it to sell illegal connectors.

I discovered this the day Tandy announced that it has greatly enhanced its lap-held Model 100 micro by adding a link to Telecom Gold's electronic mail service. Any owner of Tandy equipment can now join and pay only £24 rather than £100, and get a free month's free trial use of the service.

Tandy president, John Roach was as little pleased as I was by the Government's attitude to machines to be connected to the system. At the launch of this new Gold service, one bright know-all, anxious to impress everybody with his encyclopaedic knowledge of communications, asked why Tandy hadn't launched the Model 100 with a built-in, direct-coupled modem — as it has in America.

The answer, of course, is that it takes so long to get a modem approved that if Tandy had decided to wait until it did have one approved, we'd still have no Model 100s.

There is absolutely no sign of this tedious process being rationalised so that it merely checks for simple safety regulations on new products.

So, I was delighted when word leaked out that Telecom's own modular jacks had been proved to be illegal.

When the modular jacks first appeared, I was incensed to discover that American equipment couldn't be plugged into them, because Telecom had designed a different version. I accused Telecom of shutting the door to imports and causing users unnecessary difficulty, especially those of us who occasionally have to take our computers to America.

Not at all, said the well-briefed spokesman. This wasn't an attempt to shut out competition, but to protect the customer: the American sockets weren't safe. British ones were safer, and you couldn't get your finger in them.

It turns out you can. European regulations prohibit the installation of such unsafe devices.

I regret to report that I laughed like a drain.

Insufficient information?

Lovely to see that the Micromail package, as provided by Pulsar, includes a direct-dialling modem. Exciting to see how it will dial up Telecom Gold, log onto your Micromail identity, and control the whole electronic mail system.

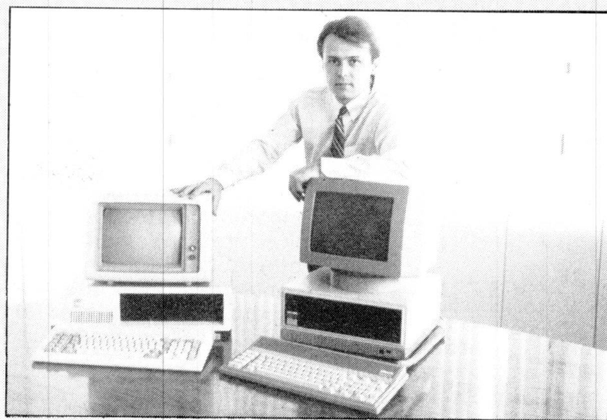
Just a small niggle, then: why can't you use your micromail software and modem to connect to any other information source?

Technically, the reason you can't is simple: Pulsar has set the software up so that you can't.

I complained to the head of Micromail (via electronic mail). I also found that you couldn't make use of another Telecom Gold facility — the option of attaching to another account — if you know the password.

He said that security considerations made it necessary.

Meanwhile, should you want to use Micromail to link up the Dow Jones share price index, to read the Diane scientific database, or contact the University of Oslo to link up to The Source of Compuserve, you need a different piece of software.



You have to give Ashley Ward credit for candour. He's head of Intelligence UK, a company which has just announced that it's taking on the new Olivetti M-24 — at last, an Olivetti micro that is IBM-compatible!

His reasons: well, first, the obvious ones about delays on deliveries of IBM computers. 'We are satisfied that the Olivetti is 100% compatible with the IBM PC with the exception of delivery,' he said merrily, 'and what is more, it is cheaper, carries more facilities as standard, and runs a much faster processor.'

Other reasons?

Olivetti gives a bigger discount, he says. It's a discount 'in a very different league to IBM.'

True, and a point worth making in private to IBM (most people would think) — but is it really the sort of thing you want to shout about to your customers? Well, possibly it is. At least your customers know that you're less likely to go out of business for lack of profits...

Details on (01) 740 5758.

To the best of my knowledge, nobody else has written any software that will work with the ACT Micromail modem, so you need another modem, too.

What a bargain, Pulsar!

Northern outlook

I'm looking forward to testing the BBC add-on box from Northern Computers, because not only does it take eight extra ROM chips, but it actually has a little indicator light to show which ROM chip is being used.

The BBC's system of using 'firmware'—permanently-available software—involves switching from one ROM chip to another under software control. Getting the chips into their sockets, however, calls for a screwdriver, a skilled hand in extracting chips and inserting new ones, and a fair amount of patience.

The trouble normally centres on knowing which chip is in use. With so many people making plug-in software for the machine, it has already reached the point where typing '*EDIT' can select either of two products, and the only way of knowing which is to know which is furthest on the right.

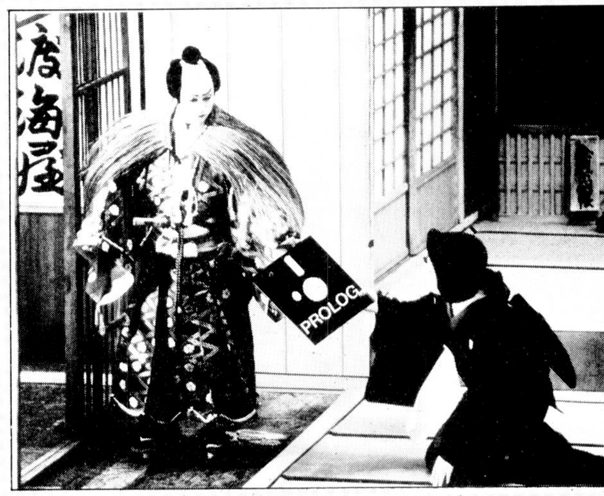
Beebug, the users group, has come up with an interesting answer to this problem—the suggestion that all software houses get an identifying letter. So, instead of typing *EDIT you type *BEDIT for Beebug edit, or *AEDIT for Acorn edit, and so on.

Computer Concepts, says Beebug, has started incorporating this idea using the C prefix. 'We would like other software producers to contact us so that a unique prefix can be established for each house,' he says. Let us hope there are no more than 26 such houses...

The other advantage of the Northern Computers Micropulse box is that it is outside the BBC case. You don't have to open up the main box to get eight more chips into your library. It costs £50.

The company has also launched a 'buggy' which can be driven around your floor. At £29, it can't be a really precision turtle-type robot, but it should be interesting enough to perform robotics experiments. And the company does include a training course with it.

Details from (0928) 35110.



I suppose the idea of painting a floppy diskette onto this period photograph was one way of illustrating the sale of a software package called Prolog to the Japanese, by Expert Systems.

I'm impressed, every bit as impressed as the Samurai in the picture obviously is, with Export Systems' invention of the 12in asymmetrical diskette.

Worthwhile venture

The bad news for the micro business is that the expected boom in software sales (for all the people who had ben given micros for Christmas) didn't happen.

People who were forecasting turnover of £60 million this year have revised their forecasts down 40%. People who were thinking they would just break even are winding down their companies, and putting up new front companies and fall-back companies.

The other side of the coin, says Sulis Software of Bath, is that educational programs are doing rather better.

'More people want to do something more worthwhile than test only their reflexes on arcade type games,' it says—and points to its range of French, literature, and other O-Level aids on micros.

Details on (0272) 24963 from Sulis' publicity agent.

Monitor improvisation

To get good colour display from an Oric, a BBC, a QL, an IBM, a Commodore, or an Atari micro, you need a monitor, normally costing £250 or so. What would you say to the idea of paying £85 for it?

The price is possible, if you can find an old colour TV set and take the broadcast receiving section out.

And a company has been set up in Scotland to take ex-rental sets and convert them into exactly such animals.

I'm told that since it set up in April, demand from retail stores has been so enormous that it is already short of production capacity, especially with orders coming in from overseas. However, they have started appointing a dealer network, and the screens should be available in the shops soon.

The only drawback I've been able to discover is on Commodore and Atari micros, where there will be some problems getting sound out of the system.

Those micros normally use standard TV sound, but in order to get a licence to operate the new company has had to agree to disconnect the speakers.

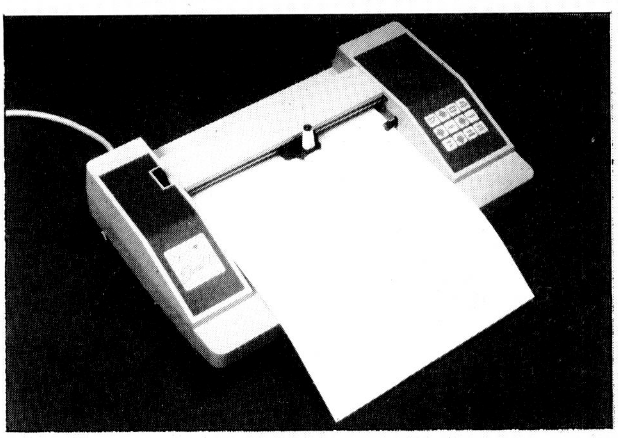
I don't know of anybody making a sound-only box for those machines, but if any exist, I hope they will write in and correct me, quickly.

The monitor building company is called Doublemode, and details about it are available from the Irvine Development Corporation which is very proud of the new company. The corporation can be contacted on (0294) 72431.

Picking up the pieces

The Atmos has transformed the way the world sees Oric, from being no more than 'just another toy' into a 'well-styled, cosmetically-attractive, likely seller' (see Check Out in May, *PCW*).

Attracted both by the new box and operating system (with diskette) and by the fact that Sinclair Spectrums are still selling in greater numbers than they are being made,



Very like Hewlett Packard's very nice plotter, but cheaper and made by somebody else: the Sweet-P plotter from HAL Computers costs £498 plus VAT. The picture shows the plotter: also attached is a sample of the ultra-high resolution graphics (the writing is done by the plotter graphics) it is capable of.

Plug it into any machine with a Centronics interface, and it has its own graphics language with 19 graphics commands that control drawing vectors, text and special functions such as page size and length. Its resolution goes down to 0.004 of an inch—that is, 250 steps per inch.

Details from HAL on (0252) 517175. The manufacturer, by the way, is Enter Computers in America.

Prism has started distributing the range.

Prism has had to contend with much speculation about its future as one of the largest distributors of micros, ever since it stopped being exclusive on the Spectrum.

Rumours surround both its own financial viability (it was said that Prism couldn't finance the Christmas rush, and it was said from within the company, too) and the turbulent nature of its dynamic managing director, Bob Denton, who, it was repeatedly said, 'rubs people up the wrong way.'

Now Denton has handed over the reins of the company to a successor (no comment at press time) 'who wil be better at working with warehousemen and order clerks,' (his words), and the distribution range is bigger.

As well as Oric Atmos, Prism will be handling the Enterprise.

That machine remains a totally unknown commodity until its launch in September. All the euphoria surrounding its first announcement has faded in the long delay since, and most of the software houses who were planning to write programs for it have decided to concentrate on the Amstrad instead.

However, getting a big distributor is a start.

Almost exactly a year late, the imitation IBM made for £400 by Advance, has started appearing on WH Smith shelves (see* Benchtest *on page 136).

The Advance 86 appeared in prototype form at the last* PCW *Show where it astounded visitors with its size, and where the designers said that they were now going to put a slim-line model into production.

The slimline model, however, is not yet announced. WH Smith will be selling two versions: a cassette-only version (loading software from audio tape systems) and an add-on diskette box.

As an audio cassette machine, the Advance suffers from the trifling but nonetheless damning problem of having virtually no IBM software available. As a diskette machine it suffers from the enormous problem of the size of the two big boxes.

A year ago, when people vaguely thought that the IBM was a good idea, this mightn't have mattered. This year, many people have a very good idea of exactly what software they want to run. And it isn't available on cassette, nor is it likely to be.

Obviously WH Smith will do well for the beast, but I still don't think it will take off like a jet. We will have to wait until there is some cassette software, which Smiths' Softeam is working on.

Then, perhaps, sales might start flowing.

A kit of bits

One way of getting a portable IBM PC is to take all the electronics out of the big box, and put it in a suitcase.

A kit of bits, with a handle, is available from Micro-Marketing (Electronics) which is selling the Colby conversion kit. 'Only screwdriver and wrench are needed — no soldering is necessary,' it claims, and it supplies a nine-inch amber screen too.

Details from (06285) 29222.

Printing the difference

Tandy's inkjet printer is the best way I know of getting colour onto paper, and it does it pretty well. However, not all programs can operate with Tandy peripherals, and Epson probably reckons that it will sell quite a few of its new £560 plus VAT colour (ribbon) printers.

The price is nearly £200 more than the Tandy, but it has the advantage of turning itself into a bog-standard Epson black ribbon printer unless told to do otherwise — which makes it very easy to use things like WordStar with it. Letters in blue or brown ink are very effective — when intentional. Sometimes, black ink is actually necessary.

Versatile joystick

The programmable Downsway joystick (known to Spectrum users) is now available in an Oric and Atmos variant.

You press the keyboard key which your video game says means 'up', move the joystick to where you want 'up' to be, and press a button. After that, you handle the other seven directions (including diagonals) and you're ready to play.

Cost £30, including VAT. Details on (03727) 27222.

Free air space

An enormous fuss arose in Cambridge following a report in a computer trade journal that 'Yorkshire TV programmes on computers will be sponsored by Acorn.'

The report, says my sources at Yorkshire TV, is wrong. Within seconds of that report appearing, an anxious Nigel Searle was on the line, barely audible for the sound of steam coming out of his ears. The explanation was as follows:

Yorkshire is indeed doing a TV series, which it had originally hoped would centre on the proposed ITV micro. When that was killed, it decided to make it around a wide selection of home micros instead.

However, it appears that Acorn did discover the Yorkshire plans early on, and offered to help, as did other people, by supplying material. And during the making of one episode, based on the Electron, a journalist wandered into the studio (by invitation) and came away with the mistaken impression that the whole series was based on that machine.

The Yorkshire series goes on the air in June. At around the same time (starting June 7) Thames will start another series of its *Database* programmes, this time networked around the country, not just in London.

What makes this series special will be the serious attempt the team is making to keep up with current affairs, rather than concentrating on purely 'gee whiz' stories about how tiny chips are.

One episode, for instance, covers a visit to a Hong Kong computer store, where *Database* was able to buy an 'Apple' and software worth well over £2700 (in this country) for £500. The 'Apple' wasn't made by Apple, of course, nor was the software the original stuff. It was all fake. But very good quality 'fakery' — electronically better than the original, said our expert.

The producer, Michael Feldman, says that the idea is 'to provide hard consumer information, rather than aiming to get people trying to write programs for the sheer academic pleasure of it'.

Fortunately, I don't have to give too many details here, because Thames is putting them all on Prestel and Oracle.

Promises, promises

The old Mattel micro, the Aquarius, won't lie down and die: its designer, Radofin, is pushing ahead on the basis that Aquarius is now

IN 1965 IT WOULD HAVE FILLED A HOUSE...

'comfortably the cheapest 16-colour home micro on the UK market', and the company insists that sales are booming throughout Europe, the Middle East, Far East and Australasia.

For those of you who accidentally bought one because of a shortage of something else, the news is of promises — promises of a RAM pack to upgrade it to 36k, four colour printer, and a light pen.

Then later in the year, Radofin promises to break your hearts by launching the Aquarius II, 'which incorporates a full typewriter keyboard and built-in Extended Microsoft Basic.'

Details in the UK from Radofin Electronics at Hyde House, The Hyde, London NW9 6LG or through publicity agents CSL on (01) 637 8481.

Optical lead

You can now be the proud user of a fibre optics printer cable for your micro. Close inspection of a four-way mains adaptor pinned to the wall of the Optronics stand revealed that, as well as the coffee machine, the sockets held fibre optic RS232C cables piggy-backing on mains plugs.

The advantages of fibre are longer links — up to 50km without loss of signal strength, compared with a measly 50 metres for ribbon cable. Fibre optic cables don't interfere with, nor are they interfered with by, electrically noisy environments, so they can be laid next to the AC mains ring around the skirting board.

Being the envy of your friends could turn you into the bane of your bank manager: a fibre optic RS232 cable to link your micro and printer will currently cost you a hundred quid. Even at that price you'll need to be quick to stay ahead, as rumour has it that Acorn is already talking to Optronics about fibre optic options for Econet.

Optronics is on (0223) 64364.

Hand in hand

For those who merely want to look at pages of Prestel, the new Tandata modems and software could perhaps cause some slight confusion at first. They are very clever modems, and quite clever software, and Tandata has been a bit clever too.

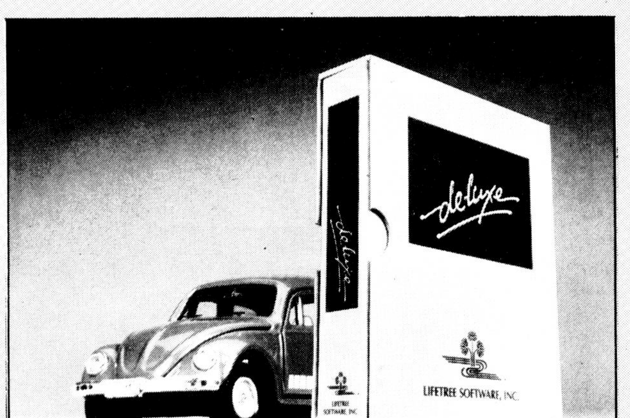
The model of modem announced as the TM100 at £86 will not be available for long: instead, a slimmer version that you can stand the telephone on will sell for £97 (plus VAT) under the TM110 label.

It can be connected to an IBM, a BBC Micro, an Apple II, a Commodore anything, and a CP/M micro, using software supplied by Tandata at prices from under £20 (for the BBC Micro) up to £150 for the IBM.

The important thing to realise is that the cheap software really isn't much good without the Tandata modem. It's designed to work with Tandata's own modems: it does things like dialling phone numbers and switching baud rates, and it might confuse your Prism modem.

The IBM product needs some more serious research than appears to have been done. It has a plug-in chip, which you put on the graphics board, replacing IBM's own graphics chip.

Putting a new chip into the IBM isn't a two-second giggle. It's a laborious job, and if, once you'd done it, you discovered that one of your favourite other programs suddenly had little triangles instead of circles, you might be vexed. Tandata doesn't know of any programs

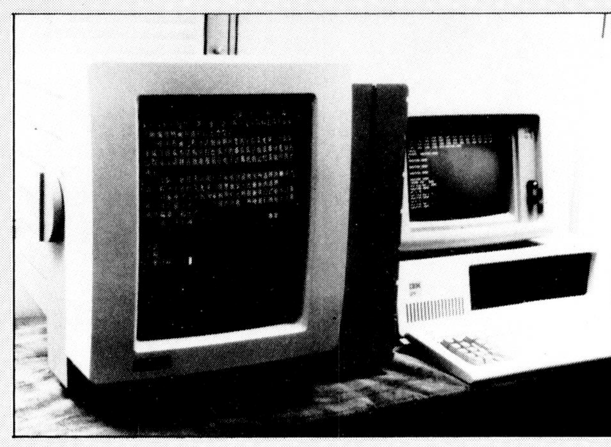


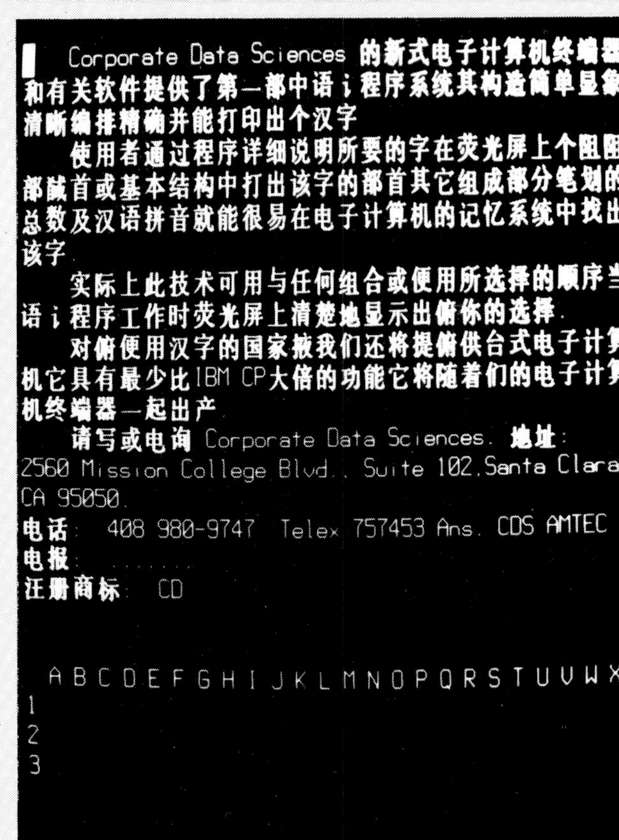
At £264, the word processor Volkswriter Deluxe has one major drawback — it is designed almost entirely for the IBM PC. On that machine, however, it is regarded universally as excellent.

There have been two versions of Volkswriter so far: this third, say critics, is easily the best, and is also easily the best (according to the Ratings Book) for the IBM.

One unique facility quoted by the suppliers is the Note-pad, which can be used to add a line, or a block of text, to a file on disk when you are editing a different file. And a text-merge program for customised letters, labels and mailing lists is included with the main program.

Details on (01) 940 3606.





At around £4000 you may not want to use this display for Chinese characters — but, says its supplier, you might find it useful for text processing.

The fact that it can handle kanji, both from pre-defined characters and also by building up the characters from their component brush-strokes, means that it can handle an amazing variety of type styles in other languages, and can also handle complex graphics.

Most text editor screens, of course, cannot.

Details from Corporate Data Sciences on (01) 236 2251, or direct in America on (408) 980 9747.

IN 1972 IT WOULD HAVE FILLED A ROOM...

which this might affect, but then again, it doesn't claim to have researched the market exhaustively, either.

The top-of-the-range Tandata modem, the TM200, isn't yet approved. So a cut-down version of it, the TM120 will be sold with a wire link at the back. Cutting that link will make it capable of running at standard 300 baud duplex, as well as 1200/75 baud (Prestel standard) or half duplex. But if you buy it at £167 plus VAT and cut the link, you will be operating illegally.

For the Apple II family, the deal is best for those who don't have a serial card. Tandata supplies one of its own, including software and cable, for £87 including VAT — software alone is £46.

I told you it wasn't simple.

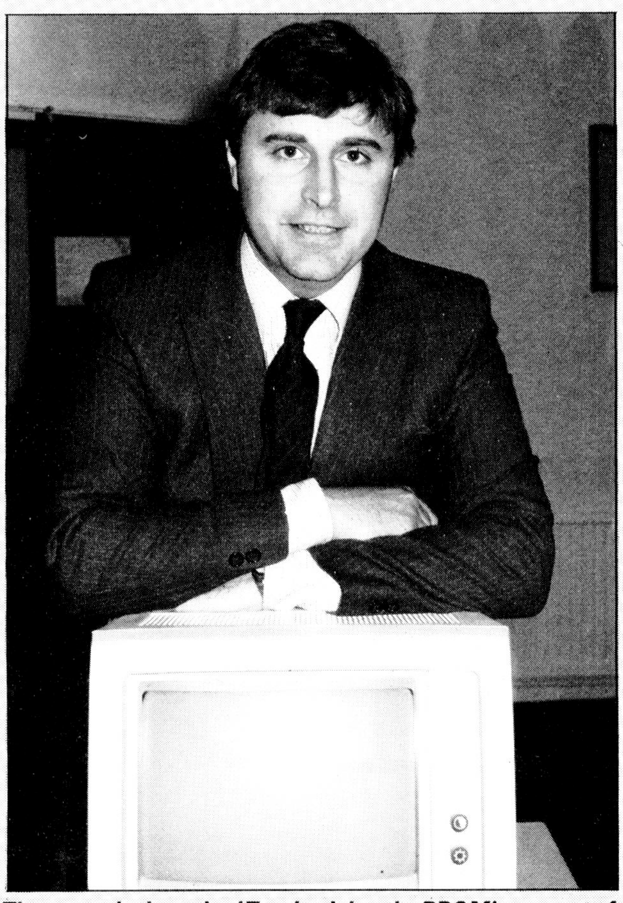
Take your pick

The Pick operating system has a serious rival. APT's Magic is, like Pick, more of an operating environment than a system. This has not escaped the notice of the men from Pick, who would dearly like to examine Magic more closely. Rumours of breach of copyright actions do not perturb Magic's MD Tony Stevens, who points out that Magic began life on ICL System 10 minicomputers back in the early seventies.

Magic was up and running on the Panasonic JB 3000 at Birmingham. The feature which distinguishes it from other operating systems you can buy is its intelligence: Magic integrates the data dictionaries with the operating system proper. Pick currently only supports a database environment, whereas Magic includes word processing functions which, via a telegraphic command language, have instant access to database information.

Alpha sorting and string matching make retrieval easy. Words are indexed by first and last character, so to retrieve 'Computer' you type 'CR'. All operations run through a high level statement, for example: File Customer (CR) If Balance > Credit-limit (CR) List Name-address Balance Credit-limit Contact (CR) Go.

I won't attempt to go into more detail here because we'll be taking a closer look at the system in the near future, but with a spreadsheet facility on the way, Magic might soon be a serious contender in the Mainframe/Symphony/Open Access category of integrated software, but for the time being Magic is supplied in turnkey form to suit users' particular application requirements. Magic is on (01) 262 2444.



The man who launched Torch, giving the BBC Micro a sort of CP/M capability, has now decided to give the machine a sort of IBM capability.

Martin Vlieland-Boddy has launched a company called Data Technologies, which is selling a product called the Graduate. This provides MS-DOS for the BBC Micro.

The company says that both models of the Graduate have 128k memory capacity as standard, and are fully diskette-compatible with the IBM. The smaller version has only a single (400k) diskette drive; the larger version has twin drives, plus a full set of Perfect this and that software.

Price: the small one is £600 plus VAT, the big one is £869 plus VAT.

Exactly how compatible the system is with IBM is something that we must wait for evidence of. The official launch has been scheduled for June 14 at the Computer Fair, and the actual release date to the buying public must remain purely speculative.

Alladin and his magic mice

A new database for the Apple III and a mouse-control language running under ProDos for both Apples will shortly be announced according to well-placed sources at Apple UK.

The database, Alladin, will be relational *and* multi-user, while the mouse driver is a high-level interpretive language supporting windows. Users of Appleworks (see *Checkout* on page 184 of this issue), however, needn't hold their breath: a mouse implementation for this integrated package is unlikely before the end of 1984.
Jerry Sanders

BBScience

Are you looking for variance analysis and the chi-squared, not to mention Wilcoxson and Mann Whitney correlation tests, for your BBC Micro?

One place you might look is on the list of Finersoft, a new house specialising in scientific applications. Bstat, for example, performs both parametric and non-parametric statistics with probability values included in the results. If that means anything at all to you then you'll doubtless be impressed by the fact that confidence limits are provided! Further details are available from Nick Finer at 30 Edna St, London SW11.
Jerry Sanders

Giving your floppies the boot

You'll soon be able to buy Boots own brand floppy disks. MCS (no expansion) is the Swiss company that produces Boots and other 'own brand' cassettes, and it has plans to go into volume disk production sometime this year.

Judging by your response to our free 3D program offer (*PCW* April 84), MCS cassettes are very popular with *PCW* readers. 40% of the cassettes sent in to us for duplication were Boots' brand.

MCS pitch at IDMS was that people prefer to get junk cassettes instead of junk mail — cassettes don't get thrown straight into the bin, and there's even a chance people might have a listen before recording over the sales message! The idea is obviously catching on: no less than a dozen of the 120 exhibitors at Communications 84 were handing out pre-recorded cassettes with PR messages for home listening.
Jerry Sanders

Belgium blues

If you're living in Belgium — hard luck! A Belgian floppy disk manufacturer exhibiting at Montreux and speaking on behalf of the Belgian computing fraternity at large

Epson reshuffles in key new marketing strategy

OK, all you smart arses out there who spotted our deliberate error with the Epson ad last month. We just wanted to make sure you were all paying attention!

Let's hope Epson appreciates the extra publicity it gained as a result.

IN 1978 IT WOULD HAVE FITTED IN A CAR...

explained that the Belgian Post Office has a novel approach to approving phone modems: it doesn't accept them for approval at all. On receiving an assurance that he would not be named, the exhibitor added that he spoke for all his communications-loving countrymen in professing undying admiration for British Telecom and its forward-looking policy makers.

It's true what they say — you can't be a prophet in your own land, especially if your initials are BT.
Jerry Sanders

One computer, one job

Launched at IDMS: the Scriptomatic Mailer 102, a dedicated address computer. Don't laugh, but all its 6502 chip does is service a 32k address database program. Double compact disk drives each hold up to 2200 addresses, and the display is a 16 by 40-character green phosphor screen. Labels are printed on an integrated 80cps dot matrix printer, or peripheral printers can be addressed — Centronics interface is standard, serial optional.

I'm told that there's a big market for such machines — the advantage is that on power-up you get straight into the file manipulation menu without any DOS start-up routines.

Also getting its first airing at IDMS was the Scriptomatic 201 Address printer. This does away with labels by feeding envelopes straight into the print head, at a rate of 3000 per hour. You can use it with any micro as it has both serial and parallel interfaces. Maximum address size is 400 characters (upper-case only).

Details on both the above from Terry Mosely at Scriptomatic on (01) 445 0163.
Jerry Sanders

Good news, bad news

OK, those of you who've been bemoaning the fact that *PCW* binders are no longer big enough to hold 12 of the bumper issues we produce these days. We've redesigned the binders to hold six issues. The bad news is that we've had to increase the price to £4.50.

The new binders are available from the address given in Back Issues, page 248.

Mole scandal as Bird defects

Amid cries of 'cover-up' and 'resign', the Sunday Times mole who has been working inside the *PCW* office undetected finally defected last week.

Jane Bird, 17, TV and radio superstar, had been liaising closely with her controller via a dead-letter box in the Gray's Inn Road. Experts at *PCW* believe it could be months before the full extent of the penetration becomes clear.

PCW staff were too shaken to speak. Only one distraught soul was heard to mutter: 'Our great leader was truly great. Irreplaceable, a tragic loss.'

Panasonic quietly unveiled its IBM plug-compatible transportable micro, the Senior Partner, at COMMS 84. It's a Compaq lookalike with a difference, and the difference in this case comes in the shape of an eight-inch thermal printer set into (and flush with) the top of the case.

Screen is a green nine-incher switchable between 40-and 80-column display. In graphics mode it handles 640×200 monochrome or 320×200 colour. The colour card is included providing RGB output as long as you have a suitable monitor.

It's a comment on the way Japanese companies work that the Senior Partner (RL-H7000 to its friends) is a product of Panasonic's audio division — and three other divisions are all developing laser disks independently.

No wonder the Japs are so good at competing with foreign companies — they practice on each other.
Jerry Sanders

Lisp discount offer

To help you get the best from the Teach Yourself Lisp series (see page 150) *PCW* has arranged special discounts on several Lisp packages. Identify your machine from the list below and send the offer tab on page 152 with a cheque for the full amount to the appropriate address, stating clearly which machine it is for.

Machine	Address	Cheque (includes VAT and p&p)
Spectrum NewBrain	Serious Software 5 Wimbourne Avenue Kent BR7 6RQ	£10.50 (Normal price £15.50)
CP/M-80: QX-10 Televideo Kaypro Sirius SuperBrain Apple II Lynx Laureate Transtec Tatung PC2000 NEC 8000 Pied Piper DRS-20 TA P3 & PC BBC B	Software Ltd, for... 2 Alice Owen Centre 251 Goswell Rd London EC1 OR Text 100, for... South Black Lion Lane Hammersmith London W6	Supersoft Lisp: £75 (Normal price £115) Microsoft MuLisp: £112 (Normal price £170)
IBM PC	Text 100 Address as above	MuLisp (MicroSoft): £112 (Normal price £170)

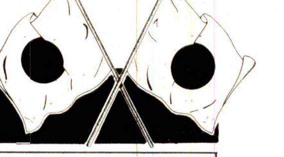
IN 1983
IT WOULD
HAVE
FITTED
ON A DESK
TOP...

...IN 1984...


THE EPSON PX-8.
184K IN A BRIEFCASE.
EPSON
VIEW ANGLE
REC
EJECT
MICRO CASSETTE
STOP


SCRN INS
CLR DEL
HOME BS
RETURN
SHIFT
NUM GRPH
CTRL

NEWS FROM JAPAN



CP/M-80 and CP/M-86 software to run under MS-DOS . . . a pocket computer for car insurance salesmen . . . the Japanese equivalent of the IBM PC . . . Shinichiro Kakizawa brings you the latest news from the Japanese hot-line.

Shinichiro Kakizawa is a computer technology and applications consultant, and a freelance journalist. He has worked in the computer industry for twenty years, originally on mainframes, and for the last five years on micros. Fujitsu and NEC are among the companies he has worked for in Japan, Singapore, the Netherlands, and the UK. He has been involved in policy setting for the Japanese fifth generation project and in Britain he participates in SPL's fifth generation project, Insight.

Multi O/S software

Megasoft is selling a package which allows CP/M-80 and CP/M-86 software to run under MS-DOS. This interesting approach comes in the form of interface software which will run immediately below MS-DOS (versions 1.25 and 2.0). Data can be shared between MS-DOS and CP/M, exchanged, and stored on the same disk. The package is called the EM/3 O/S Integration Adaptor and costs around £190. Manuals are unfortunately only available in Japanese at the moment.

1Mb, 1.6Mb in one floppy drive

There is good news for micro users who have difficulty knowing what to do with ever-increasing piles of diskettes in different capacities and densities for a variety of systems.

The majority of the machines on display in shops in the electronics bazaar, Akihabara, Tokyo are now equipped with a standard 1.6Mb floppy disk drive. Only a year ago, the standard was more like 1Mb. As elsewhere in the world, micro users in Japan are facing difficulties with stacks of incompatible floppy disks.

Matsushita (also known as Panasonic) has come up with a decent solution for this problem. Its new drive, called 'Super mini FDD JU591', can read/write two different capacity disks with a single drive by automatically changing the rotation speed of 5¼in disks between 300rpm (1Mb) and 360rpm (1.6Mb). Diskette type can be identified automatically within one second of insertion. Matsushita's plan is to produce 200,000 units this year at its Hananomaki factory in Northern Japan, and it has been talking to a number of micro assembly makers around the world. You may see new micros with this drive before Christmas in the UK. The price (note that it's only for OEM sale) is £200.

From black/white to colour in the classroom

Panaboard is a little expensive but a very useful tool for classroom training. What you have written on a black/white board can be hardcopied in colour, transferred to VDU or large video projector, or stored on disks.

Panaboard is from Matsushita, manufacturer of the IBM 5550; price is a little over £10,000. Last year Oki developed a black and white hard board copier, and this new machine is certainly a welcome addition to the micro classroom.

Let your watch do the walking

A watch capable of memorising telephone numbers for 10 people is being sold in Japan by Casio. The watch has a one-chip CMOS CPU, stores 10 sets of four alphabetic characters and 10 numeric digits, and provides a calculator function as well. The idea is similar to the Seiko wrist computer, but unlike the Seiko, this watch does not require a separate keyboard for input. How it will sell is yet to be seen, but my feeling is that watch computers have now established themselves firmly in the market.

Many more with a wide variety of features will soon follow, including offerings from Sanyo, Citizen, Ricoh and Seiko.

Calculating the premium

Sharp and Unix Ltd (a Tokyo system house) have developed a special purpose pocket computer for helping car insurance policy salesmen to calculate the premium quickly. The machine is based on the popular CE-1253H with 24k RAM. It has special function keys needed for car insurance, and cannot be used for any other purpose. This trend of developing more dedicated pocket computers suitable for only one task is a forerunner of future pocket expert systems. Sharp expects to sell a lot — over 20,000 — this year.

Fuji diskette drives

Fuji Film Company, best known for films and cameras, has begun shipping 1.6Mb 5.25in diskette drives in limited quantity. IBM has said that it will make 1.6Mb drives its next standard device. Fuji is the fourth Japanese manufacturer to produce a 1.6Mb drive after Y-E data, Matsushita and Hitachi. It seems that anyone in this market who offers a diskette of less than 1.6Mb per sheet will be regarded as a failure.

Industry overview

In the business microcomputer market, the biggest difference between Japan and the rest of the world is probably the non-existence of the IBM PC (I daresay you can buy it somewhere in Tokyo if you really want it). Instead, IBM Japan sells the 5550, something similar to the PC/XT in terms of horse power. The machine has been reasonably successful and large mainframe users are buying it, but unlike the PC, you can't buy the 5550 in the high street micro shops in Japan.

The major supplier of microcomputers in Japan is, of course, NEC. It has sold over half a million systems, including the ever-popular 8-bit PC8000, PC6000 series, and 16-bit PC9000 machines. NEC has now firmly established itself as the leader in Japanese micros, mainly because it had the right machine at the right time when the micro took off in Japan four years ago.

NEC enjoys the same privileged position that the IBM PC has in other markets. Every software house writes packages primarily for NEC.

MSX arrival

There is no clear distinction between machines to be used by home users and business users, unlike the UK where the Spectrum, ZX81, and BBC Micro are clearly for home and educational use.

In Japan, everyone has been using NEC, Sharp, Fujitsu, Hitachi, OKI, Mitsubishi, and Toshiba machines whether it's for home or business.

The only difference is the money spent on peripherals. Home and hobby users spend less, but the CPUs are usually the same. However, this situation is rapidly changing as more and more MSX machines are joining the force. MSX machines are cheap — current offerings are around £150 for an 8-bit 64k average machine. It will be interesting to see if the MSX standard is accepted worldwide.

Among the major suppliers, Sord is one of the first and has a lot of enthusiastic followers mainly among large business users. Sord's PIPS spreadsheet package has been as popular as VisiCalc.

It's rather sad that we don't see many world popular brands like Apple, Tandy, and Commodore. You can get hold of them if you wish but, except at the beginning of the micro fever, they haven't sold well.

Wrong pricing, inadequate advertising budgets and lack of decent support networks were the reasons.

It's very sad indeed that major companies of this stature let themselves down in this way. END

INTRODUCING THE NEW OLIVETTI PERSONAL COMPUTER.

IT'S SO FRIENDLY IT EVEN GETS ON WITH ITS BIGGEST RIVAL.

The new Olivetti M24 personal computer is operationally compatible with its biggest rival.

This means it can handle all the most popular software. But it handles it faster.

The M24 also has many other unique features including a higher resolution screen with 16 shades of grey.

A modular format that provides greater expandibility.

And superior ergonomic design. All at a competitive price.

To find out more call in and see the M24 in action.

FROM £1595·00 (EX.VAT)

KCB MICROS LIMITED
106 St Leonards Road, Windsor, Berkshire, SL4 3DD
Tel: Windsor (07535) 50111 Telex: 848521

Authorised ACT dealer Authorised IBM dealer

Specialists in Computer Aided Design

olivetti

Please send me full details on the new Olivetti M24 Personal Computer

Name ____________________

Position ____________________

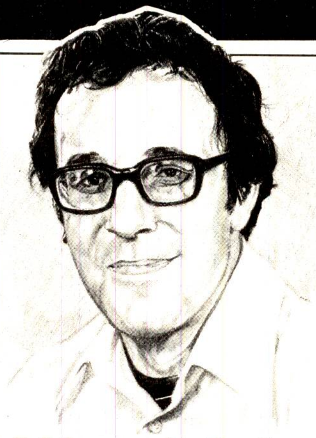
Address ____________________

____

____________________ Tel: ____________________

YANKEE DOODLES

Apple making its comeback with the 11c, TI waging war against the IBM PC and slow start for the PC Junior. David Ahl reports.



A bigger byte for Apple

In a full day extravaganza in San Francisco followed by a road trip around the US, Apple Computer introduced the Apple IIc around the theme 'Apple II forever'. In the eyes of many security analysts, Apple has been fading for the past 18 months. Recent events, however, seem to have reversed that opinion.

The Apple II line now consists of the Apple IIe, in appearance identical to the original Apple II, but with a much smaller and more efficient chip set. It has eight expansion slots and a starter kit with 64k, one disk drive and software and sells for under $1000.

The Apple IIc is new from the ground up. It is software compatible with the earlier II family, but packs 128k of memory, a CMOS version of the 6502 CPU, a half-height disk drive, and all interfacing into a briefcase-size package not much bigger than a notebook computer.

It uses only 41 chips in total and can be powered from an external AC transformer, auto battery or portable battery pack. Cables are all labelled with icons and an RF modulator is included. In addition, a set of five instructional disks is included with the $1295 starter package.

The system design, bundled package and colourful packaging suggest that the IIc is aimed at the home market, although Apple's distribution through upper tier retailers means that professionals and businessmen will also be important customers.

On the Macintosh front, many companies have completed testing the machines and the large orders are starting to roll in. Peat, Marwick, Mitchell & Co, one of the big eight accounting firms, recently placed an order for 2000 Macs. Apple has made numerous evaluation sales of 10 to 20 machines, and several Fortune 1000 companies are said to be on the verge of placing large orders in the 500 to 1000 unit range.

Apple is backing the introduction of the IIc and Macintosh with enormous advertising campaigns, reportedly $20 million for the IIc and $15 million for the Mac to make sure that they are household names by the end of the summer. Also, Apple is on the verge of patching up its disagreement with the Computerland chain and should be back in within a few months.

In a low-key announcement, Apple disclosed it was discontinuing upgrade development efforts on the Apple III. The main projects were programs to boost the operating speed from 1.4MHz to 6MHz and expand memory, two items about which users were unhappy. As president John Sculley said: 'In the long term, we don't see the Apple III fitting into the direction Apple is going.'

Low sales for PC Junior

At the IBM Shareholders' Meeting in late April, chairman John R Opel told shareholders that the PC Junior 'hasn't yet been as successful as I would like it to be.'

His remark indicates that IBM is less than pleased with sales of the PC Junior, and faced with head-to-head competition from the Apple IIc, IBM appears to be considering some design and pricing changes.

Following the recent introduction of several Japanese supercomputers, several analysts opined that IBM is behind in its plans for introducing its next mainframe generation, the Sierra. Opel countered these notions and said that 'IBM doesn't talk about product plans or experimental work.

Almost concurrently, from its Essex Junction, Vermont research facility, IBM announced that it had produced an operational 150 nanosecond, one M-bit dynamic RAM chip, the first made by an American company. While Hitachi, Fujitsu, and NEC have announced experimental one M-bit chips, 256k is the largest commercially available size. Analysts expressed interest that IBM had bypassed the 256k market and jumped directly to one M-bit.

The chip uses a silicon and aluminium metal oxide semiconductor technology and produces circuit elements as narrow as one micron. Other new processing steps allow adjacent storage nodes to be as close as one micron with the use of 15 nanometer composite dia-electric covering material.

Peachtree gets integrated

Peachtree Software recently announced Decision Manager, a multiple-window integrated software package that includes word processing, spreadsheet, data management, graphics, telecommunications and terminal emulation functions.

Designed primarily for the IBM PC-XT, the package will also run on a dual floppy disk configuration. The package requires 256k and accepts either mouse or keyboard input.

Users can define up to 20 windows, and up to 10 can be displayed simultaneously on the screen. Decision Manager was designed to complement Peachtext 5000 and all files are both data and command-compatible between the two systems. Peachtext 5000 has more comprehensive word processing capabilities than the program included with Decision Manager.

Unlike some other highly integrated packages such as Lotus Development Corporation's Symphony and Ashton-Tate's Framework, Decision Manager is more a collection of stand-alone programs bound together with a windowing umbrella program. However, it is one of the few that offers a micro-mainframe link with its IBM 3270 terminal emulator. According to some analysts, that could be its 'ace in the hole'.

Who dares wins?

In a bold marketing effort, TI 'dares' consumers to compare the TI Professional Computer with the IBM PC. The campaign theme, 'Dare to Compare', will appear in a heavy TV, magazine, direct mail, and point of purchase advertising programme.

Consumers are invited to visit any of 700 TI dealers, all of which have a TI Professional Computer set up next to an IBM PC. 'The same demonstration program run on each computer will clearly establish TI's superiority,' TI officials said. TI will give a TI solar-powered calculator to consumers who complete the demonstration.

Although the IBM PC is more expensive than the TI unit, TI officials said that price will not be part of the comparison.

To encourage dealers to set up the test in their stores, TI has even offered to provide an IBM PC-XT for the demonstration, if necessary. While the makers of many other PC-compatible computers have taken shots at IBM, none has been so blatant as TI.

Will it work? Stay tuned.

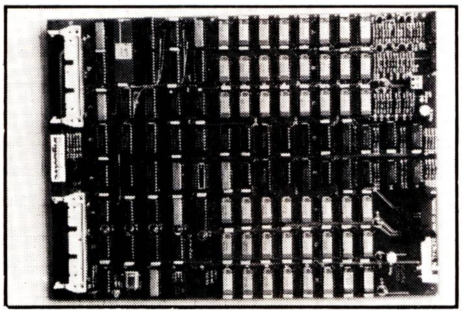
Random bits

Spectravideo has shut down operations in anticipation of a debt restructuring that would give control of the company to its manufacturing arm, Bondwell Holdings of Hong Kong . . . Zilog, Motorola, and National Semiconductor have put Coleco on credit hold and stopped shipping chips to the company . . . Intellivision Inc, a company set up to market a video game system formerly sold by Mattel, is negotiating with Samsung and others to secure a line of TV sets, VCRs and other consumer electronics products to market under the Intellivision label . . . Pioneer unveiled an MSX computer that loads software from laser video disks and superimposes computer and video disk signals for spectacular game effects . . . IBM offers PC/IX, its version of AT&T's Unix operating system for $900 . . . Although the US marketing strategy of most Japanese computer manufacturers has been to offer a standard operating system (CP/M or MS-DOS), the biggest selling Japanese computer in the US is the Epson QX-10 which uses a unique Valdocs operating system designed by Rising Star Industries. END

GRAPHICS

DIGISOLVE offer you a way to increase your graphics speed and resolution. Using a high speed graphics processor, our cards draw lines and characters FAST. The graphics processor works in parallel to the host machine and gives you the power of using a co-processor specifically designed for graphics. With drawing rates of up to 1,500,000 pixels per second, lines appear instantly to speed up your plotting.

With the resolution, we offer new possibilities for software and systems, both in monochrome and colour on a large range of computers.



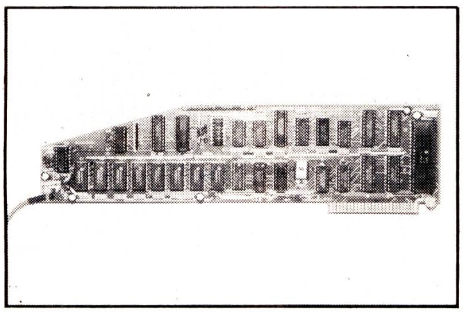
COLOUR GRAPHICS CONTROLLER

DIGISOLVE offer you high resolution colour graphics too. Designed to plug into any computer with a bus host adaptor. The VGP64 gives you 512 x 512 pixels in 64 colours. With its own vector processor and 384K bytes of memory, your computer can become a sophisticated grahics system. **64 COLOURS** or 8 if you insist, not many do! **4096 COLOURS** now you can really paint a picture. **384K BYTES of RAM** or 768K Bytes with 4096 displayed simultaneously. **2 PICTURE BUFFERS** give you help with animation. **GREY SCALE OUTPUT. EXT VIDEO SYNC LOCK** available for making video tapes. **APPLE, SAGE, PET, IBM, S100, VME BUS, RS232,** centronics, all have interfaces available to make use of our fast hardware. New ones are coming along all the time so give us a ring if your requirement is not listed.

8 COLOURS £899, 64 COLOURS £999
4096 COLOURS £2000 + P&P + VAT

The above prices are box units including power supply but excluding computer interface.

SOFTWARE PACKAGES: Painting and Slide generation, Business graphics, Architectural 3D design.



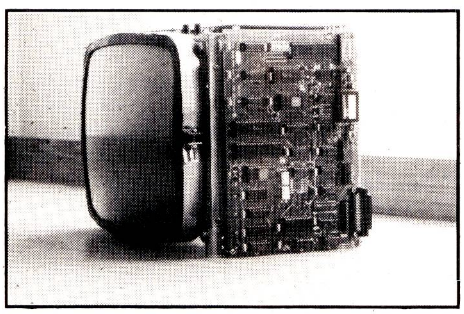
APPLE II

DIGISOLVE's Apple II High Resolution Vector Graphics Processor card quadruples the screen resolution and saves using up your Apple's memory. The enhanced Applesoft support disc supplied with our card provides powerful graphic functions and simplifies the conversion of existing software.

512 x 512 pixels resolution. **FAST** 1,500,000 pixels per second. **MEMORY** an extra **64K** on the card. **TEXT** to 85 characters by 57 lines. **CURSOR** drawing features. **SOFTWARE** 18 new functions are added to Applesoft and extra utilities too, all with source listing. **OUTPUT** to a dot matrix printer or save images on a disc. **PASCAL** and **TASC** Compiles supported too.

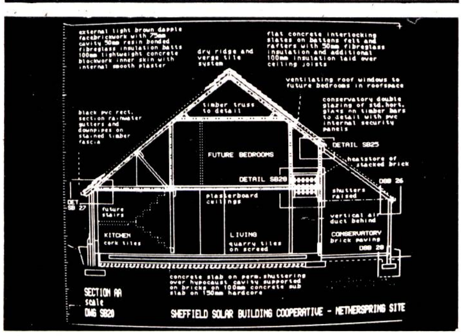
£399.00 + P&P + VAT

SOFTWARE PACKAGES: Art and Design, Business graphics, Painting, Slide generation packages. Architectural design and modelling, Kitchen design and Visicalc preboots.



VDU BOARD

DIGISOLVE offer you the cheapest way to make a scrolling VDU with our intelligent 80 x 24 VDU card. With over 50 control functions, the card works up to 19.2K baud.
80 x 24 DISPLAY optional 40 x 24 or 40 x 12.
TRUE DESCENDERS on properly formed characters in an 8 x 12 matrix.
BLOCK GRAPHICS
FULLY SCROLLING display
UP TO 19.2K BAUD via RS232 communications port.
KEYBOARD AND RS232 DATA INPUT
£180.00 (1 off) + P&P + VAT



COLOUR GRAPHICS TERMINAL

The new **FRONTIER** monochrome and colour high resolution graphics terminals are fully compatible with Tek 4014 terminals at an amazing price. The high line rate flicker free monitor and advanced electronics provide an exceptional graphic display terminal.
512 x 720 DISPLAY, 1K x 1K STORED PICTURE PAN, ZOOM & SCROLL to move the display about. **LOCAL EDITING** with macros and software definable character fonts.
PALLETTE OF 4096 COLOURS
FLICKER FREE DISPLAY due to high line rate monitor and advanced electronics working non-interlaced.
19″ SCREEN OPTION AVAILABLE
PRICES FROM £1495.00 + P&P + VAT

CUSTOM DESIGNS

DIGISOLVE have staff dedicated to design consultancy and are helping many industrial users with custom design packages. Our experience in designing display equipment, character or graphic based, and microprocessor controllers may help you with your special projects. Please do not hesitate to contact us if you require further details.

Digisolve

DIGISOLVE LIMITED
AIRE & CALDER WORKS
CINDER LANE
CASTLEFORD
W. YORKS WF10 1LU
(0977) 513141 (6 lines in), 513382, 510511
TELEX 557661 AGRAM

PCW welcomes correspondence from its readers but we must warn that it tends to be one way! Please be as brief as possible and add 'not for publication' if your letter is to be kept private. Please note that we are unable to give advice about the purchase of computers or other hardware/software — these questions must be addressed to Tony Hetherington (see 'Computer Answers' page). Address letters to 'Communications,' Personal Computer World, 62 Oxford Street, London W1A 2HG.

Dressing up

Your sense of humour is ridiculous.

I've never yet seen David Tebbutt in a bowler; why should he be obliged to wear one just because you hand him a QL to review?

Murdoch Mactaggart, Caxton Computer Systems, Yeovil, Somerset

(It was his idea! — Ed)

Another view

I would like to make some comments concerning David Tebbutt's review of the Sinclair QL in the June issue of *PCW*.

I cannot agree that the QL keyboard 'feels good and positive in operation'. My six-year-old Tandy TRS-80 Model I has a better keyboard than the QL! Moreover, the keyboard does not appear to have 'n-key rollover' which might cause fast touch typists a few problems. The control key is where most keyboards place the shift key which will upset more than a few people.

Your reviewer cannot have tested the SuperBasic properly, as it is almost unusable, in my opinion, owing to the large number of bugs that it contains. The most serious bug seems to be due to improper stack operation, and results in a total system crash if certain types of program, especially those using recursive procedures, cause a run-time error. In some cases, I am sure that the program I was testing was correct but a crash still resulted! Following such a crash, in which the system 'locks up' and does not respond to the keyboard, it is necessary to press the reset button which means that one's laboriously entered program (that keyboard again) is lost. The slow speed of the Basic is also rather annoying, considering that the QL has a 32-bit processor. The machine I was using, incidentally, did have a functioning AUTO command, so it was probably of a more recent vintage than the one reviewed.

Two members of the Independent QL Users Group (IQLUG) of which I am Acting Chairman, who have each received one of the first batch of machines, have confirmed the presence of some serious bugs, as did Sinclair.

David Tebbutt omitted to mention that multitasking is not accessible from SuperBasic; you have to do it in assembler language which is difficult at present as firstly, there is no assembler available and secondly, Sinclair does not provide any information on how to do it.

Due to lack of time, the only applications package I was able to try was Quill, the Psion word processor. Even this has one or two bugs — I accidentally pressed the wrong keys when in command mode and the system 'locked up', causing me to lose the document I was working on. Moreover, a member of IQLUG found that if the Microdrive cartridge that Quill requires in drive 2 is faulty, the system can crash without warning and you lose all your input.

I found Quill extremely slow especially when scrolling through a large document, due to Microdrive accesses which seemed to occur every few seconds.

Block move and copy operations are rather tedious with Quill compared to WordStar, for example. On what is supposed to be 'state-of-the-art' software, columnar operations are not available.

Quill is probably adequate for letter writing; I would hate to have to use it to write a sizeable report or a book.

Most of the systems that have been shipped so far were not supplied with any information on the SuperBasic interpreter. Some owners, like the ones whose machine I was using, will have received the early provisional manual, but since the SuperBasic on the machines that have been delivered so far bears very little resemblance to that described in the provisional manual, it's not a lot of use!

To sum up, Guy Kewney's comments in his Newsprint section seem to correspond much closer to the machines that I and other IQLUG members have used. It will probably be a very good machine eventually; at present I would describe it as a retrograde step, rather than a quantum leap!

Leon Heller, Acting Chairman, Independent QL Users Group

(Sinclair confirms that multitasking can only be implemented at the operating system level. You cannot run more than one program at once at any other level. Benchtesters test system commands but they don't write complex software on the system. Incidentally, it is standard practice to save a program before running it. The Benchmark timings show the speed of the Basic — Ed)

Beating the opposition

The article by Tebbutt (QL Benchtest, *PCW* June) is the biggest con I have come across in a long time. In what is clearly an effort to beat the opposition with the 'first full Benchtest' you have quite dishonestly produced this article. The so-called 'Benchtest' is done on a pre-production model with incomplete software by a hack who is so heavily unscientific in his approach — even unobjective — that what we end up with is an item which gives little more information than does the Sinclair announcements themselves.

I was conned into buying the magazine purely because of what I thought was going to be a proper in-depth evaluation of a machine which is surrounded by a great deal of uncertainty — being one of those people who has held off ordering and parting with cash until more reliable information is available.

Thanks for nothing, and can I have my money back?

Rod Akehurst, Ilkley, West Yorks

(David's review is a reflection of the sorry state of the machine, which was supplied to us by Sinclair as the one customers would receive. Unlike other magazines, PCW waited until it had a machine before publishing a review — Ed)

Ethics or otherwise

Your columns have been buzzing recently with debate about the ethics or otherwise of copying software.

On one side is the software producer who can see his revenue disappearing into other people's pockets; on the other is the software user who wants to make a back-up copy or study the listing of the program.

However, the facts are too stark for blathering about the 'rights of the computer owner' to inspect other people's programs. When was the last time you heard someone who owns a hi-fi unit saying that it was practically illegal that he wasn't able to read the music on the record? For a best-selling program, the average is *one* legal copy for every ten in use. Contrary to popular belief this flood of copies is not due to some evil baron in a castle tower, fingers flashing over commercial copying machines, but is due to the social exchange of programs — you give me Pacman version no 10027453 and I'll give you Centipede version no 343176.

The economics of the copying boom are simple. The more copies being exchanged, the fewer people who buy the original tapes. This leads to a drop in revenue for software companies, who are then unable to spend as much money on development and

ACT Pulsar 'File Transfer'

It's easy to get the impression that the differences between micros are there to tie you down. How do you upgrade from 8-bit Apple to today's 16-bit micros, or copy files between different 16-bit machines, without hours or even days of laborious data re-entry – and all the dangers that entails?

The answer is Pulsar File Transfer. It puts Apple, Sirius, Apricot and IBM straight onto the same wavelength, transferring file type, text, binary or graphic information directly at up to 9,600 bits per second.

With the correct combination of Pulsar File Transfer packages you have access to complete software freedom between IBM-PC, Sirius and Apricot and instant transfer of data from Apple. Multiple files can be sent or received with a single command, while an in-built error-checking facility guarantees absolute accuracy.

For more information on the Pulsar connection just return the coupon. Vive la difference!

ACT (Pulsar) Ltd.

FREEPOST, Birmingham B16 1BR or call 021-455 7000.

PULSAR SOFTWARE

Please send me further details on the Pulsar File Transfer:

NAME ______________________

POSITION ______________________

COMPANY ______________________

ADDRESS ______________________

TEL: ______________________ PCW 7 84

whose programs deteriorate as a result. The thing spirals until everyone is copying worthless programs. Copying will kill software and wipe out a brand new industry at which Britain had been leading the world.

In an effort to put off those with less willpower, houses such as Acorn and Ultimate have been devising complex locks which prevent everything but copying the tape bit by bit. The naive reserve their venom for these devices, calling them everything from 'inconvenient' to 'an infringement of civil liberties'; what they should be doing is bemoaning the fact that to prevent the further spread of illegal duplication, these routines should have to be devised.

The sooner home computer owners realise that software copying is not only illegal but counter-productive the better. Meanwhile, perhaps the government will reinstitute the punishment of boiling in oil for large scale offenders.

Justin Holmes, Ipswich, Suffolk

(Isn't it a bit 'naive' to expect micro users young and old not to swap and share programs out of an altrusic concern for software houses?—Ed)

Confessions of a pirate

I must confess to an act of piracy in my life. Having failed to obtain a program from the UK supplier, and having tried the US firm that produced it and been told it no longer supplied Osborne, Kaypro and Xerox formats, I obtained a copy. After two and a half months of trying what else could I do!

However, if I could have bought it I would—they even returned my order along with the photocopied form they sent me saying, in effect, 'Get lost'. As far as the Acorn case goes though, a program which a legitimate user cannot back up is not fit for the purpose for which it is sold. If Acorn is listening hear this: I never buy software that I cannot make a back-up copy of, and that's one of the reasons I don't and won't own a BBC computer—too much of the software is copy protected.

I haven't the time to sit around breaking copy protection schemes, although I have occasionally done so for entertainment as it makes a change from crosswords. I still feel that *PCW* should take the side of the user and not its advertisers, but I appreciate that there are financial considerations involved.

There are other and better answers to piracy than copy protection, and any copy protection scheme can be broken. I managed to bypass all the security on an ICL 1907 a few years back and it was running a fairly secure operating system. Computer security is better now but it isn't yet up to preventing a determined user making a copy of a program if he tries hard enough. All the frustration and anger he goes through while doing it is likely to be directed at the people who 'copy-proofed' the program initially. Enough said.

PCW is now the only UK computer magazine I read every month without fail (yes, I buy my own copy). Keep it up.

Mike Liddle, Mailbox 80, Liverpool

The case for a European keyboard

I was very interested in the article 'The History of the Keyboard' by Conall Boyle in the April issue of *PCW*. Although I do not claim to be an expert in this field, I have become aware in the course of my work as an employee of an international non-governmental organisation that it's certainly untrue that 'qwerty is the standard layout throughout the known universe'. Indeed, there are so many variants from it that, for example, IBM offers no less than *nineteen* different keyboard arrangements with its text processing system in Western Europe and North America alone. Of course, some of those differ only in the characters additional to the Latin alphabet, but there are three main families in which the qwerty layout is not followed.

As well as the German layout qwertz, there is the Italian qzerty and the French azerty, which are also used in certain other countries. But within these families, there are several variants depending on the arrangements for typing accented characters, or additional letters. This is not merely an academic point, as it is vital in the design of text processing systems to ensure that the keyboard can generate the messages that the program and the printer are expecting. In particular, accented letters can either be coded as a single byte, or as a sequence of two bytes, the accent (non-spacing) preceding the unaccented character with which it is to be displayed. Furthermore, in some cases it may be possible to use a 'backspace' operation to generate special characters, such as the (Danish) å, with a keyboard that is not basically equipped for them.

English and Latin are the only languages for which the 2 x 26 characters on the standard qwerty keyboard are sufficient, and so none of the numerous microcomputers on the British market are directly suitable for use as the basis of text processing installations intended for other European languages. Of course, until a microcomputer with a keyboard appropriate for the local language becomes available at a reasonable price, some people will make do with a model having only the ASCII character set in a qwerty layout, especially for applications where full literary facilities are unnecessary. But there must be many others, like myself, who are still waiting for one or other of the British manufacturers to produce a variant of their ASCII machines that conforms to the standards of at least one continental European language. Ideally, of course, a 'polyglot' keyboard suitable for several different languages would be preferable; it might possibly be based on the standard for typewriters in Switzerland.

Alan F Reekie, Brussels

PS—This was typed on an Olivetti Praxis 35 electronic typewriter with azerty keyboard, which can cope with French, German and Italian as well as English, thanks, in part, to 11 keys with alternative characters depending on the setting of the KBI/KBII switch.

Sharp MZ-700 software & books

I was very surprised and disappointed with your reply to 13-year-old Lesley Martin (Computer Answers, *PCW* June) regarding the availability of software and books for the Sharp MZ-700 computer. Anyone considering the purchase of the MZ-700 could be discouraged by your response to Lesley and may consequently reject this excellent computer if they think there is no back-up.

I own a Sharp MZ-700 which I purchased in December 1983 and I have found four software manufacturers other than the one mentioned by Surya.

They are as follows:

Solo Software
Unit 95B
Blackpole Trading Estate
West
Worcester WR3 8TJ

Knights TV & Computers
108 Rosemount Place
Aberdeen, Scotland

Sharpsoft Ltd
86-90 Paul Street
London EC2A 4NE

Kuma Computers Ltd
12 Horseshoe Park
Horseshoe Road
Pangbourne, Berks RG8 7JW

All four sell by mail order and only Kuma make a charge for postage and packing (£1 for orders under £20).

In addition to educational, business and games software, they also sell language tapes such as Forth, Pascal and machine code. I have bought software from these manufacturers and find it good quality at a very reasonable price (from as little as £3.99).

There are also two books available on the MZ-700 at the moment: PEEKing and POKEing the Sharp MZ-700, and The Sharp MZ-700 Explained. These are also obtainable by mail order.

May I say that apart from this criticism, I generally find your magazine excellent.

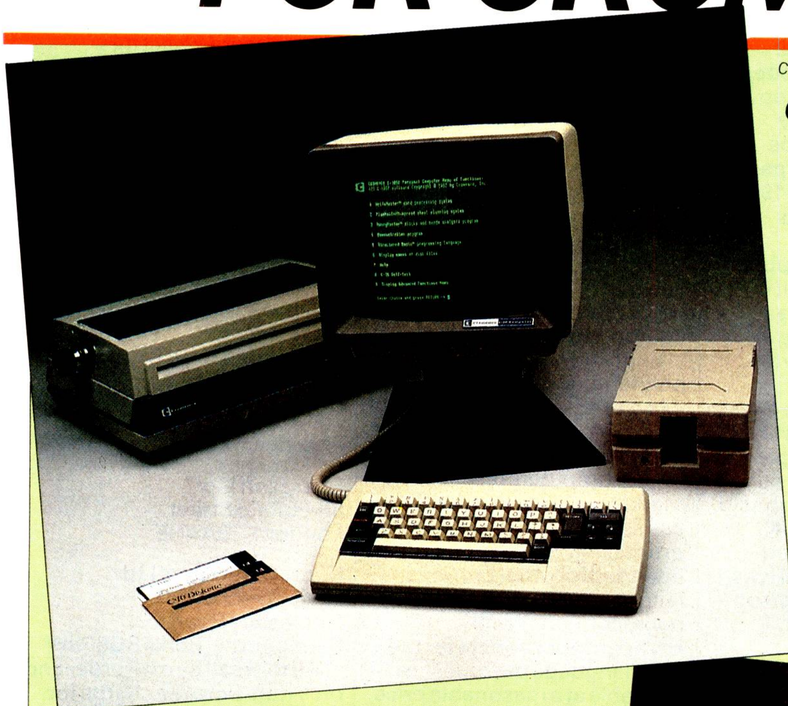
Mrs Janet Spall, Bordon, Hants

Computer industry comments

The May issue of *PCW* contained an advertisement for a complete business system for around £500. The system comprised a proper keyboard, word processor, daisywheel printer, and a Buck Rogers arcade game. It transpired that before being able to use this system, one had to buy a video game which costs about £100.

Either one has a business computer, or a video game, but

CALL MICROCENTRE FOR CROMEMCO



CROMEMCO C-10MP

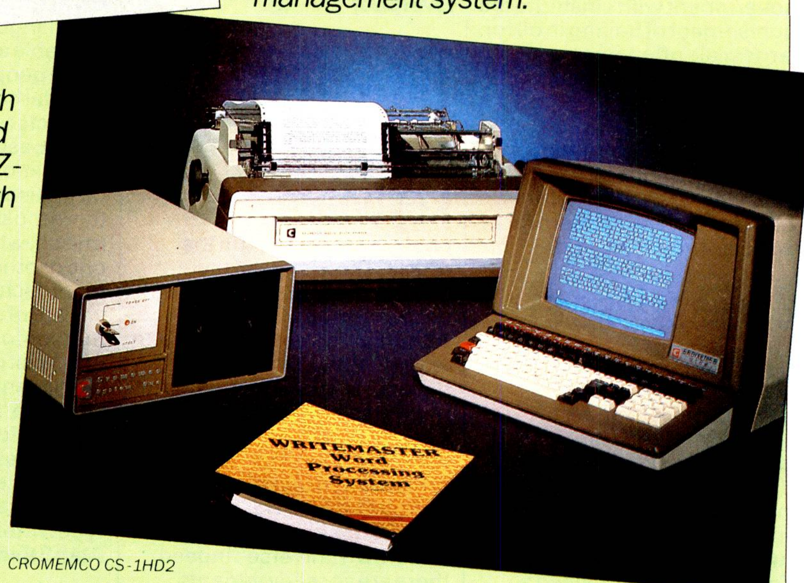
Cromemco's C-10 personal computer includes a Z-80A microprocessor with 64K Bytes RAM, 24K Bytes ROM, high resolution 12" green phosphor 25 x 80 screen, detached keyboard, 5" floppy disk drive with 390K Bytes capacity, communications and printer ports, terminal emulation, graphical characters, CDOS operating system and 32K Structured Basic.

In the C-10MP we add a software "Super Pak": a full screen editor, WordStar, MailMerge, Writemaster, CalcStar and PlanMaster spreadsheet programs, Chess game, MoneyMaster financial analysis and InfoStar data base management system.

The System One Hard Disk computer, with an integral 21 Megabyte Winchester hard disk, includes Cromemco's dual 68000/Z-80A DPU processor (featured below), with 256K Bytes of RAM and 390K Bytes of floppy disk storage.

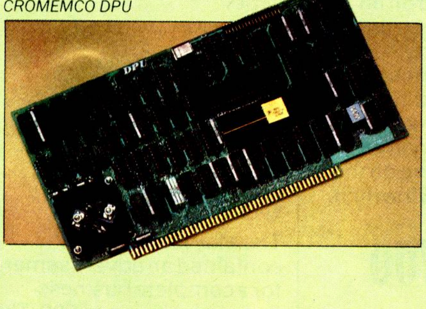
The S-100 bus has eight card slots, sufficient for expansion utilising Cromemco's range of interface cards for high resolution colour graphics, process control, analogue-digital data conversion and telecommunications.

A choice of operating systems includes CDOS, CP/M and CROMIX.



CROMEMCO CS-1HD2

CROMEMCO DPU



Cromemco's Dual Processor Unit is the ultimate professional micro-computer. It combines the flexibility of Z-80A 8-bit systems with the speed and versatility of 68000 16-bit technology and an address space of up to 16 Megabytes of RAM.

The DPU can be installed in several Cromenco computers, including the CS-1 featured above. For larger applications we recommend the CS-2, with up to 4 floppy disk drives, each of 390K Bytes capacity, an optional 21 Megabyte Winchester hard disk, screen and printer interfaces plus a 21 slot S-100 bus – sufficient capacity to cope with the most demanding industrial or laboratory requirements.

With over 5 years experience of Cromemco systems, we are Cromemco's leading British distributors.

MicroCentre / Cromemco®

30 Dundas Street, Edinburgh. 031-556 7354 | 207 Bath Street, Glasgow. 041-248 2767

surely not both?

There is a certain other computer whose manufacturers claim that the graphics, colour, and 'movement' use up little or no memory. One so-called computer dealer even goes so far as to say that these functions are run from ROM rather than RAM as on other computers. Does this mean that the graphics screen always looks the same? Or is it that the computer burns eproms every time a graphics command is issued? This shows how gullible the advertisers assume the readers to be.

Basic is the most complicated, unstructured, and unreadable language currently available, apart from assembler. Why, then, are the great majority of home computers supplied with it?

As if this were not bad enough, various people are trying to 'standardise' this dreadful language by basing it on the common capabilities of the versions available on most home computers: that is, very few and limited features are available. The result is Basicode — to call this a step forward is totally naive. What this language tries (very hard, but in vain) to do is to emulate what almost every proper high level language already accomplishes, which is to have various common routines in order to make source code portable. The sub-routines that make up these languages are implementation-dependent. Due to the fact that Basic does not easily lend itself to this type of facility, Basicode increases unreadability of programs by a factor of at least 10! The actual source code for any decent language such as Forth or Pascal is usually totally portable. Basic, on the other hand, is *never* totally portable.

Students' minds become irretrievably corrupted by Basic. We would prefer a properly structured language, such as Forth or Pascal, to be implemented on home computers.

Why is it that home computer users want to 'progress' to assembler after learning Basic? Surely it's more of a backward step to do this as, these days, high level languages such as Forth are nearly as fast. The only possible use for assembler is for writing time-critical subroutines when a compiler will not produce efficient enough code. We fail to see, therefore, why you include a section on learning assembler.

To summarise, we feel that your magazine, which was once the best and probably still is, is somehow becoming more and more like the games-orientated magazines, and less serious-minded.

Anthony Hegedus & Daniel Sutton, Harrow, Middlesex

(Even high level language programs need to use assembler sub-routines at critical points for speed and efficiency. See our Teach Yourself Lisp series starting this month — Ed)

Reliable mail order firms

Your correspondent D Corbett (Communications, May) says that he will never buy anything by mail order again and advises others not to do so either.

It is unfortunate that his unhappy experience is tarring all mail order firms with the same brush just because one has defaulted.

As a radio amateur for many years and a fairly recent computer buff, I have had literally dozens of transactions with a variety of mail order firms and cannot recall ever being 'gypped'. Certainly, the electronics dealers who are now into computers can be thoroughly relied upon; in particular, I have always experienced prompt and efficient service from Watford Electronics, Technomatic and Maplin.

I think if you are careful to order from a company of repute you are unlikely to be disappointed; an offer of something cheaper than anything on the market from an unknown firm may be risky. You can get some idea of a firm's efficiency by noting how quickly they reply to enquiries. When it takes them a fortnight to reply to a request for an advertised price list or catalogue, you cannot be confident that any goods you order will be with you by return of post. 'Allow 28 days for delivery' is a warning; I have had items in the post the morning after a phoned order, so some firms can do it.

HG Lee, Upton, Merseyside

Piracy recommendation

While I would be the last to condone software piracy, I am getting a little tired of software distributors bemoaning the loss of vast sums in royalties.

To quote the managing director of Acornsoft in your April issue: 'Every illegal copy is depriving authors of their rightful royalty.' This makes the assumption that every copy made deprives Acornsoft of a sale.

Were copying to become impossible overnight, would there be a sudden increase in the collective affluence of the home computer users of Britain? I doubt it. It's much more likely that the majority of those who had been copying programs would simply do without them. The slight increase in sales to those who found they had to have a particular program might well be offset by the drop in shared purchases.

I don't have a solution to the piracy problem, except to recommend selling programs in large numbers at such a low price as to make copying unattractive, but I feel that to estimate the size of the problem by multiplying the number of illegal copies by the retail price of programs is an unjustified exaggeration.

Tom Napier, Monsey, New York, USA

(I agree — Ed)

The old, old story

Could you help me with a problem that concerns myself and, I imagine, a great many other people in a similar position.

I responded to an advert from Softek International over three months ago advertising the Softek IS & FP compilers together for £25.

After a month of waiting and a reminder note from me, I finally received my compilers to find the FP crashed the computer (that is, a system restart) every time the error routine it contained was involved in a program I tried to compile (never mind run!).

I returned the compilers by recorded delivery (received 23 February 84) with a letter explaining the problem and asking for either a debugged replacement or my money back.

After a further month of silence I sent another letter asking for my money back. After another fortnight someone contacted Softek on my behalf to be told: 'We will send you your money.'

After two more weeks of silence I am finally sick of it. Is there any way I can get my money back? I cannot afford to keep phoning London.

Thank you for an excellent magazine.

Steve Taylor, Hull

(PCW belongs to the Periodical Publishers Association mail order protection scheme. You should inform us if you have problems with one of our mail order advertisers as we may be able to help get your money back — Ed.)

Jupiter Ace 'Bigwriter'

Users of the Jupiter Ace may have been confused by the documentation accompanying my 'Bigwriter' program in the June issue of *PCW*. To clear up any misunderstandings:

1 HOME AND MOVE> are used by EMITBIG and TYPEBIG which require screen coordinates, and give a full display of five lines by eight characters.

2 SCROLL and PLOTBITS are used by EMITBIG2 and TYPEBIG2 to create a sideways-scrolling 'banner' display, consisting of a single line of eight characters.

3 Both these versions need 7BYTE? and FINDCHAR, while WRITE may be adapted to use either version.

Jonathan Hardwick, Leamington Spa

Silly processor debates

I would like to propose a method for measuring the 'size' of a processor, which might stop the silly debates about how 'big' certain processors are.

Simply add together the sizes of the data bus, the address bus and the accumulator (or the size of the 'general purpose' registers) and divide the result by four.

Here are some results:

6800, 8080, 6502, Z80, 6809	:	8
8088	:	11
68008	:	12
8086	:	13
68000, Z8000	:	14

Of course, this says nothing about the 'power' of a processor, which in any case depends on the application.

However, I would say that certain advertisements are guilty of exaggeration!

Stephen Burt, Antibes, France

Your chance to win an Epson PX-8

Reader Survey time is with us again. This is your chance to influence the development of *PCW* and perhaps win a sparkling new micro while you're at it. This year we've got Epson's latest lap-held, the PX-8, for the lucky name out of the bag. The PX-8 (Benchtested *PCW* June '84) has virtually all the capabilities of a desktop CP/M machine but weighs just 2.3kg. It has a variable angle eight-line by 80-column display and 64k RAM. WordStar is bundled in as a spreadsheet and database, and the basic machine costs around £800.

Don't despair if you're not the kind of person who wins first prizes — there are also 10 annual subscriptions to *PCW* to be won. If you've already got one, then in our great magnanimity we'll extend it for another year.

But the point of all this is to keep us in touch with what you the readers want from the magazine. Not that we're totally out of touch, of course! Lots of you phone in or write, or even come and say hello at the *PCW* Show. But this Survey gives us the chance to analyse the views of as many readers as possible. If there's anything you particularly love or hate about *PCW*, new ideas you'd like to see included or regular items you think we should dispense with immediately, here's your chance to let us know.

The Survey is used to plan the future of *PCW*, so this is your chance to take an active part in choosing the direction we move in over the next year or so. The prize draw will take place in mid-August so the questionnaire should be returned to us as soon as possible. Our thanks to Epson for providing the star prize and to you for completing the questionnaire.

Please use BLOCK CAPITALS throughout and/or tick appropriate boxes.

1 Name:______________________________

2 Address:______________________________

____

3 Age: Under 15 ☐ 15-18 ☐ 19-25 ☐ 26-35 ☐ 36-45 ☐ 46-65 ☐ Over 65 ☐

4 Sex: Male ☐ Female ☐

5 Occupation:

- Professional & Business ☐
  - Less than 10 in firm ☐
  - 10-99 in firm ☐
  - Over 99 ☐
- Education ☐
- Student ☐
- Computer industry ☐
  - Sales ☐
  - Service ☐
  - Support ☐
  - Other (please specify)____________________

____

6 Which of the following publications do you read?
Please indicate which one you think is best

	Regularly	Sometimes	
Personal Computer World	☐	☐	☐
Practical Computing	☐	☐	☐
Computing Today	☐	☐	☐
Computing Answers	☐	☐	☐
Computer & Video Games	☐	☐	☐
Micro Decision	☐	☐	☐
Personal Computer News	☐	☐	☐
Which Micro? & Software Review	☐	☐	☐
What Micro?	☐	☐	☐
Your Computer	☐	☐	☐
Popular Computing Weekly	☐	☐	☐
Byte	☐	☐	☐
Creative Computing	☐	☐	☐

Others — state which ____________________

7 Please indicate your interest in the following sections of *PCW*:

	A lot	Some	Little	None
Newsprint	☐	☐	☐	☐
Communications	☐	☐	☐	☐
Banks' Statement	☐	☐	☐	☐
Computer Answers	☐	☐	☐	☐
SubSet	☐	☐	☐	☐
Network	☐	☐	☐	☐
TJ's Workshop	☐	☐	☐	☐
Hardware Benchtests	☐	☐	☐	☐
Hardware Checkouts	☐	☐	☐	☐
Software reviews	☐	☐	☐	☐
Language & operating system features	☐	☐	☐	☐
Teach Yourself Assembler	☐	☐	☐	☐
Screenplay	☐	☐	☐	☐
Bibliofile	☐	☐	☐	☐
Yankee Doodles	☐	☐	☐	☐
Beginners' Guide to Program Conversion	☐	☐	☐	☐
Micro Chess	☐	☐	☐	☐
Newcomers Start Here	☐	☐	☐	☐
Numbers	☐	☐	☐	☐
Leisure Lines	☐	☐	☐	☐
Programs	☐	☐	☐	☐
ACC News	☐	☐	☐	☐
Diary Data	☐	☐	☐	☐
Crossword	☐	☐	☐	☐
Competitions	☐	☐	☐	☐
Chip Chat	☐	☐	☐	☐
Advertisements	☐	☐	☐	☐

8 What other topics would you like to see in *PCW*?

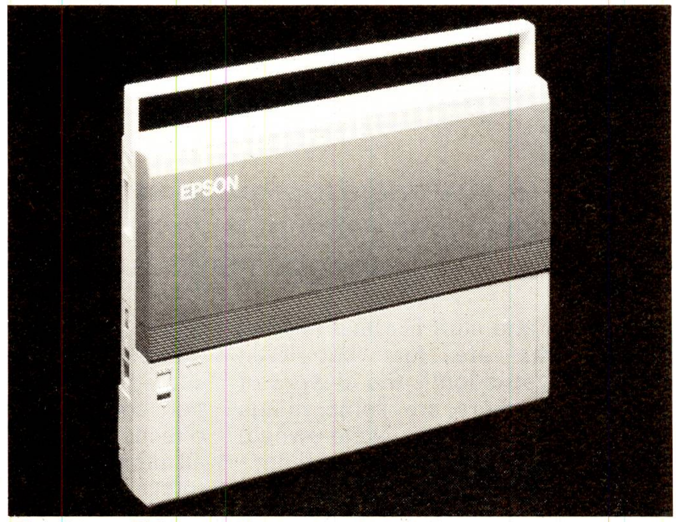
9 What other comments (if any) would you like to make about *PCW*?

10 Do you use a micro:

At home ☐
At work ☐
both ☐

11 Do you use a micro for:

Games ☐
Arcade style ☐
Adventure ☐
Strategy ☐
Simulation ☐
Education ☐
Word processing ☐
Database ☐
Spreadsheet ☐
Accounts ☐
Mainframe
Communications ☐
Scientific/Engineering ☐
System development ☐
Graphics ☐



The Epson PX-8: quality and portability

12 Do you own a micro:

Yes ☐
Which make and model?________
No ☐

13 Do you own disk drives?

Yes ☐
Which make and model?________
No ☐

14 Do you own a printer?

Yes ☐
Which make and model?________
No ☐

15 If you upgraded your system:

Which micro would you buy?________

Which peripherals would you buy?________

16 Have you owned a micro for:

Under six months ☐
Six months-two years ☐
Over two years ☐

17 How much money do you spend on software a month?

Under £25 ☐
£25-£49 ☐
£50-£99 ☐
£100-£499 ☐
£500-£1000 ☐
Over £1000 ☐

18 Do you use:

CP/M ☐
MS-DOS ☐
PC-DOS ☐

19 Do you read *PCW*:

Every month ☐
Occasionally ☐
Rarely ☐

'. . . the most capable lap-help so far . . .'

20 Apart from yourself, how many other people read your copy of *PCW*?________

21 Do you have a *PCW* subscription?

Yes ☐ No ☐

22 Do you object to your name and address being placed on a mailing list:

For *PCW* use only
Yes ☐ No ☐
For other commercial users
Yes ☐ No ☐

Personal Computer World

Divine laws?

Ever wanted to take the law into your own hands to protest about the lack of definition in computer information? Martin Banks has. He dons a ministerial cap to define his Square Laws of Information Processing.

Legislation and stuff like that is what governments are for; but even though privatisation is the in-word of the decade, there are some things which should remain state-owned. Making laws is definitely one of them.

This obvious fact notwithstanding, I have decided it's time that more legislation, or laws at least, are brought before you; laws that will hopefully clarify and organise your thought processes and help restrain deviant attitudes. These laws I have collectively defined as the Square Laws of Information Processing.

Now, before you yawn and wander off to the pub, these are not the normal type of computing laws that are bandied about. They are (hopefully) a little different. This stems from the fact that information is different from computing, and that the latter is only the most convenient tool for manipulating and storing the former. The trouble arises because the computer is so damned good at these functions that it has created a situation in which information is devalued to the point of worthlessness. There is just so much potentially available that people are fast approaching the point where they know not what to do with it.

So what we need is a set of ideas, thoughts, epigrams — laws, even — by which we can define our attitudes to the Vast Gobs of information that the dreaded computer is making available to us.

The first law that occurred to me is the following: The amount of understanding anyone has of what is happening in a particular subject area is inversely proportional to the square of the amount of information available on that subject.

This is the most obvious because it's the most fundamental. Information creates misunderstanding. The potential for this increases each time more information is made available, until a point is rapidly reached where no coherent understanding is possible at all. The real danger of this particular law, the one to which it points, is that for many people there exists the illusion that understanding actually increases with the availability of information. But this is a fallacy based on the assumption that all the information is going to somehow 'point' in one uniform direction, so that 'understanding' becomes directional and therefore obvious. As all information is, in its individual form, totally unique, each item will automatically be different from every other. Murphy's Law proves that in any given real situation, each item of information will be directly contradictory to all the others (Law One, Sub-Section One). Confusion and misunderstanding are automatic and inevitable.

The second law is more specific in nature, though it can be broadened to meet more general requirements. It is as follows: The number of mistakes made in a document rises in direct proportion to the square of the number of editing facilities available.

This obviously has its roots in word processing. It's a law that will be familiar to anyone who uses a word processing system with any degree of regularity, and can still remember the days when they used an ordinary typewriter (preferably manual). Though mustaeks, sorry — mistakes, are made with the typewriter (a fact which prompted the use of computers to edit text), it can be shown that the problems caused by correcting those errors manually created an environment of some respect for the tools being used. A certain amount of thought was given over to the task of hitting the right keys.

With the advent of computerised editing, however, the situation changes. Because it becomes so easy to change individual characters, words, sentences or whole paragraphs, two things happen. Firstly, the users promptly become careless and don't try, thus making more mistakes than before. This counteracts any savings in editing time available with a word processor. The users also begin to show tendencies of suffering from verbal diarrhoea because it becomes so easy to write lots. The end result is that more work is created than is actually needed, and in a more inconvenient form than before. This last statement refers to a personally-defined phenomenon of word processing. It's not unknown for me to write something and then hand-deliver it to the publisher while on a trip to the big city. The copy (in paper form) can easily be read and corrected while travelling on the train. It may not look pretty, but presentation is usually the least of a writer's or publisher's worries. Try the same trick with a North Star Horizon, terminal and daisywheel printer and see if Brit Rail can help you.

The third law is similar to the second in that it helps define an area of information surplus, though it specifically considers a different major area of business computing use. It is as follows: The size of the spreadsheet is at least 2.5 times the maximum level of comprehension of the person creating it, and incorporates at least twice the number of column and row headings as are actually required.

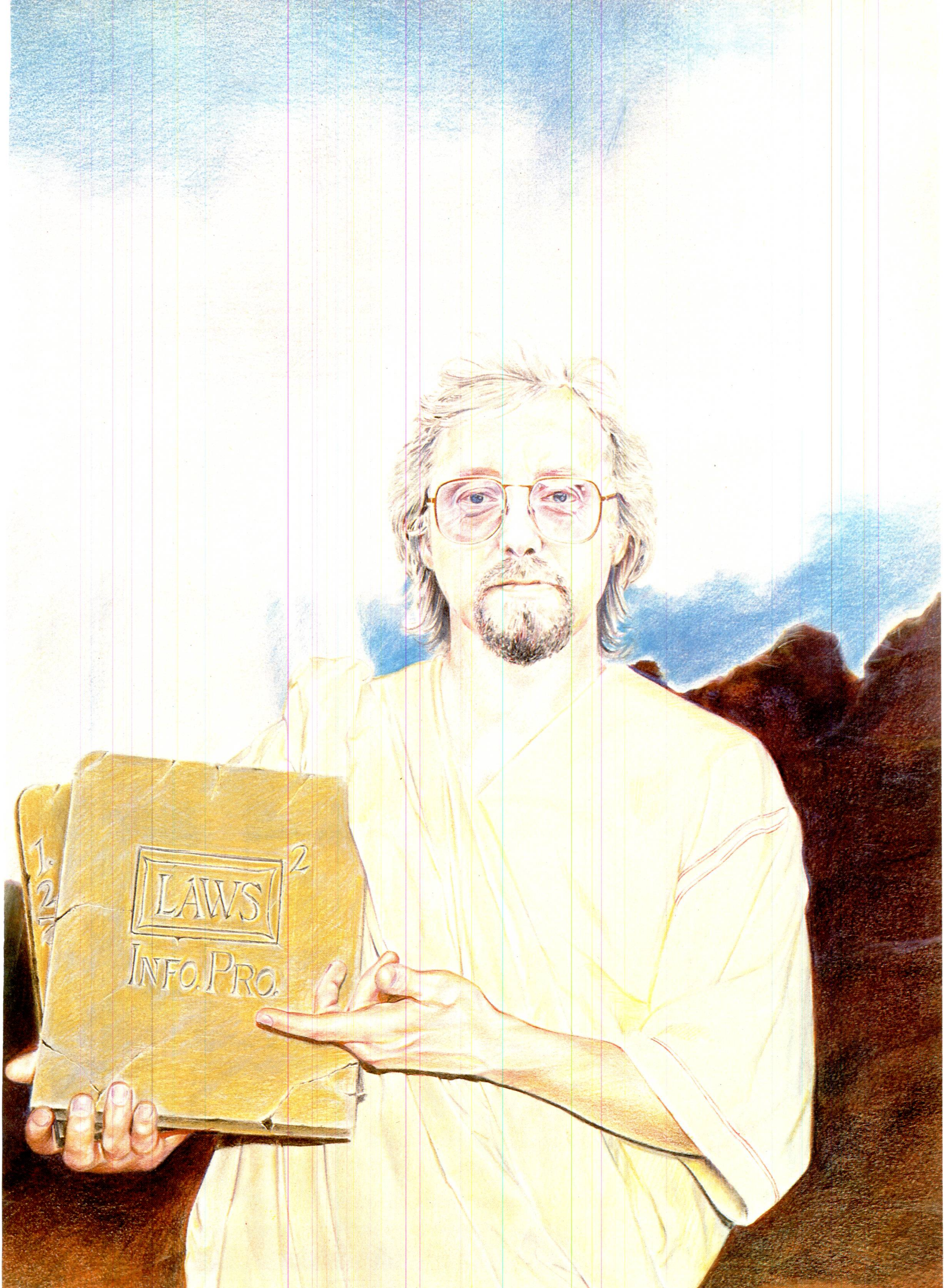
This is fairly self-explanatory, for it defines another area of the overall principle: something designed to make life easier actually makes it more complicated. The ability of a spreadsheet to define a multiplicity of different formulae with which to massage business figures means that every business person is obliged to try them all, just in case. One of the best marketing ploys ever developed was the selling of spreadsheets to business people on the 'What if . . .' fear. They don't know, but their job might depend on such knowledge, so they buy it just in case. One day, someone will come up with a 'What if you run out of What If functions' function designed specifically for such paranoias, though two far more useful ones would be 'What The Hell' and 'Does It Matter Anyway?'.

The last law, though obviously there are bound to be more, is as follows: The number of jargon words used to discuss a particular information processing subject is inversely proportional to the square of the misunderstanding of that subject.

This is a more tightly defined version of the old 'blind 'em with science' epigram, and is one which can best be seen in use by politicians, journalists, and senior directors of computer companies.

END

Illustration by Eddi Gornall



1.
2
LAWS
2
INFO. PRO.
EDDI GORNALL.

HP110

In recent months, Hewlett-Packard has accelerated its move into the personal computer market — a move which started last year with the launch of the HP 150 touch screen machine. It now presents the HP 110, a particularly well-endowed micro which features the biggest screen yet available on a portable micro and which is fully compatible with its predecessor. Robin Webster and Leslie Miner put it through its paces.

The HP 150 was a 'special' MS-DOS machine in that even the most popular software had to be revised to work on it. Hewlett-Packard's latest addition — the HP 110 — goes to great lengths to use files created on the IBM Personal Computer.

Despite weighing only 8.5 pounds and measuring 13in wide × 10in deep, the HP 110 (previously known by the codename Nomad) is packed with a number of unique features.

Many people believe that a portable computer is merely a cut-down version of a desk-top machine and that it can't really do much: only big machines which occupy desk space should be really taken seriously.

The HP 110 is going to change that perception, as is obvious from the technical specifications: it's based on the full 16-bit Intel 8086 central processor; it has Lotus 1-2-3, MS-DOS version 2.11, the Memotext word processor, as well as a selection of other software locked in ROM memory — and it runs off three rechargeable batteries.

All this comes at a cost of $2995 in the US. The machine also has an 80 column × 16 line liquid crystal display that is capable of producing graphics (such as the many types of Lotus 1-2-3 graphs) at a resolution of 480 × 128 pixels.

The HP 110 was developed within 18 months by Hewlett-Packard's personal computer group in Corvallis. Interestingly, their original idea was to build the system around the multi-application Symphony product from Lotus Development. However, delays in the Symphony project forced the HP 110 design team to use Lotus 1-2-3 as the main applications program instead.

The HP 110 is compatible with the bigger HP 150 touch screen system, and can make use of files stored on the IBM PC and IBM workalikes.

Hardware

If the HP 110 were being assessed in terms of design only, it would get quite low marks. Trendy, or avant garde appearance seems to have been the least important thing in the development team's minds.

The main system casing measures a compact 13in × 10in × $2\frac{7}{8}$in and is of the creamy-white colour so popular in computer design circles today. The whole thing is designed along the lines of a briefcase: the liquid crystal display (LCD) makes up the top half of the case, and the main system unit and keyboard make up the lower half.

The two parts are hinged together, and spring-loaded clips along the front edge keep them from flapping around while the user is carrying the machine.

Opening the spring-loaded clips allows you to flip the LCD display up into its operating position. The hinge mechanism is not like the kind of thing you'll find on your front door: it uses a combination of friction and a spring system to hold the display at almost any angle between 0 and 130 degrees.

LCD displays have distinct advantages for portable computers: they consume very little power and are much thinner than cathode ray tubes. The low power requirements allow machines using them to be run off just a few rechargeable batteries, making them truly portable instead of 'transportable'. The flatness makes it easier to produce a lightweight machine.

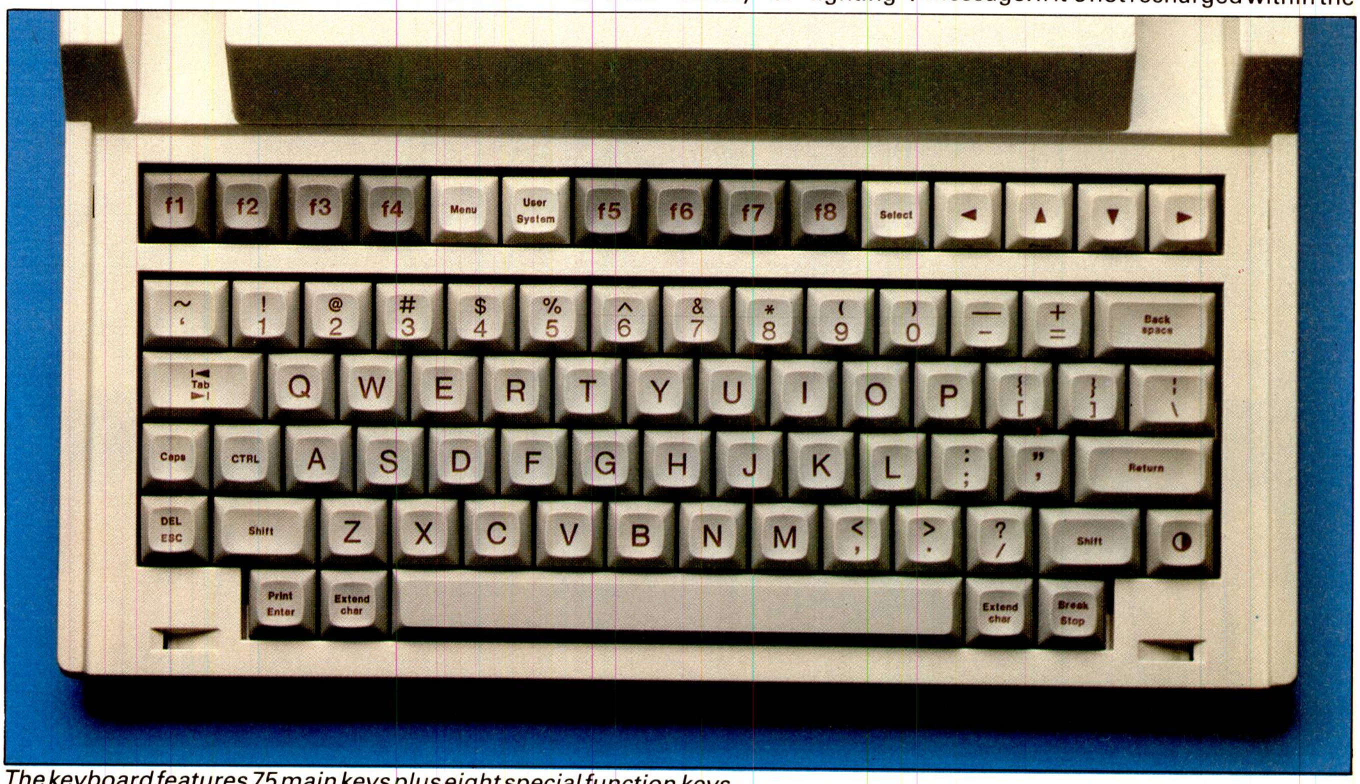
Unfortunately LCDs have their drawbacks, and none of these have been particularly well overcome on the HP 110.

As the machine is portable, it will be used in a wide variety of lighting conditions (daylight, fluorescent, 100-watt home lights, and so on). Consequently, it is important that the user be able to vary the intensity and/or contrast of the display as conditions dictate. Being able to vary the viewing angle helps, but this is not enough in itself. So, to the right of the keyboard, the designers have included a CONTRAST key which, when used in conjuction with the SHIFT key, will increase or reduce the screen contrast. The special LCD support hinge tended to 'sag' and thereby accentuate the screen glare. Using the HP 110 on a stable desk is one thing, but using it in a moving train or in a car would probably make the problem all the more obvious.

The contrast key helped but, to be frank, it's not really possible to read the screen for very long before your eyes become a little fatigued. The prototype machine also has one problem that should have been overcome by the time the product reaches the market; it was possible to see the LCD screen flicker as it refreshed itself. It's worth knowing that the contrast key also works as the system reset key if it's held down for about 15 seconds.

Once you've opened up the HP 110, it can be turned on automatically by pressing any of the alphanumeric keys. Conversely, if the machine is left switched on, but not used, for a pre-set amount of time, it will shut down the display to conserved battery power. The power source is a six-volt rechargeable battery pack which can last for up to 16 hours of continuous use.

The remaining battery power is displayed every time the machine is turned on, and when this figure drops to about one or two hours worth of energy the machine displays a 'low battery' message. If it's not recharged within the



The keyboard features 75 main keys plus eight special function keys

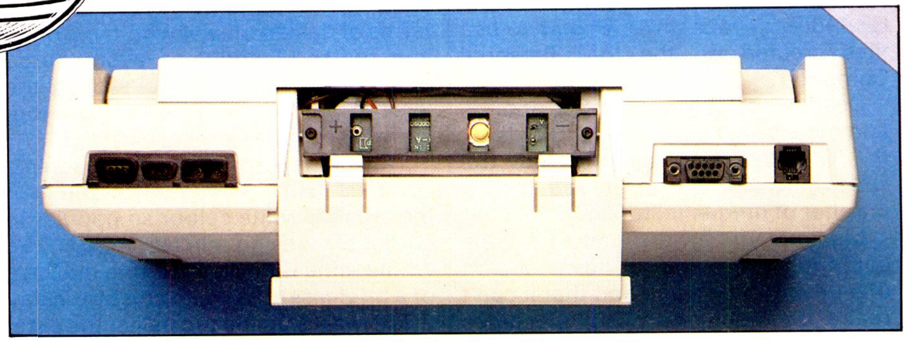
next hour or so, the machine automatically shuts down everything, locking the user out, until remedial action is taken.

There are some keys that will not turn the machine on — SHIFT, for example — but it's unlikely that this will cause any problems. The keyboard is HP 150-compatible and features 75 main keys plus eight special function keys marked f1 to f8.

In normal mode, the HP 110 keyboard produces the conventional qwerty characters. By pressing the EXTEND CHAR key, however, it's possible to generate special characters such as international currency symbols and Greek letters. EXTEND CHAR also allows the user to access functions described on the front edge of some main keys: these include + Line, -Char, Clr Line, Prev and Next.

The layout of the keyboard is acceptable, but it does have a rather 'plastic' feel to it. It wouldn't be the best thing to use for writing long documents. The cursor control keys are set in a row to the top right of the keyboard, an arrangement and position which could be a little awkward if you need to use them frequently.

The main keys, as far as the built-in functions go, are the function keys set in a row across the top of the keyboard.



All the connectors are set along the back edge of the machine

These keys do not have only one purpose — they receive new assignments each time a new application is loaded. The user is made aware of the new functions by explanatory 'labels' that appear along the bottom edge of the LCD screen.

While the f1 key might initially be identified as the 'System Config' key, once the system configuration routine has been loaded, the same key would then be identified as the 'Next Choice' key, providing the user with a way to choose among a range of system set-up options.

Although this approach is basically a good one, the HP 110 designers really didn't complete the job as well as they might. Instead of having the function keys set directly below the key assignments on the screen, the keys are set off to the left of the assignments. So, while the left-hand f1 key is fairly close to its assignment, the right-hand f8 key is not close at all. After a while, you find yourself subconsciously leaning your head to one side to compensate for the offset.

It would help substantially if there were another firm visual link between the number of the function key and the bottom-line option that was currently available.

The main CPU is a CMOS version of the Intel 8086 chip operating at 5.33 Mhz. It was a smart move to include this chip instead of the much over-used Intel 8088 chip, because the increased

The LCD, and the main system unit and keyboard, are hinged together

performance of the former is accentuated by the fact that you are using a very small machine.

Perhaps the most significant aspect of the HP 110 is the amount of memory that has been packed into the machine. In total, it contains about 656k of memory split up as 384k of CMOS ROM and 272k of CMOS RAM — an impressive amount of memory to be able to carry around in a portable machine considering that the average IBM PC has been equipped with between 320k and 512k of RAM.

The ROM memory contains the MS-DOS version 2.11 operating system, Lotus 1-2-3, the Memomaker word processing system (as first introduced on the HP 150), a simple terminal emulation package, and built-in help text. Also stored in ROM is the Personal Applications Manager (PAM). This is a front-end program which allows the user to list disk directories, copy files, or set up a link with another computer by selecting options from a menu. The PAM system first made its appearance on the HP 150.

As this software is locked away in ROM, all the RAM memory is available for user created files and programs. Of course, it's likely that users will load in additional packaged products such as WordStar and dBase II.

The RAM memory is split into two parts — main memory and electronic, or ramdisk, memory. Via the system configuration procedure mentioned earlier, it's possible to choose how much memory will be given over to the main memory and, therefore, how large an electronic disk you will have.

The combinations start off with 256k main memory and 16k disk space, and go on up to 96k main memory and 176k disk space. Whatever the size of the electronic disk, it is always referred to as drive A. All the data stored on this 'drive' is preserved as long as the batteries have enough power to maintain it. Resetting the system does not erase the electronic disk.

The ROM memory has been designated as drive B. Naturally, nothing can be saved to or erased from this 'drive'.

Up to eight external disk drives can be connected up to a single HP 110 system at one time. The external disks may be Hewlett-Packard's own impressive HP 9114A disk drive which can store up to 710k on a 3.5in disk, or the drives on an IBM or IBM lookalike machine.

The linking method is impressive and very simple. As the HP 110 has a limited amount of surface area, it would have been unthinkable to use the conventional thick cables and large connectors to link up peripherals. HP has used what is being called the HP Interface Link, or Loop. Connecting an external disk, or perhaps a printer, to an HP 110 simply involves stringing two special 16-gauge wires with miniature sockets between the drive and the computer. The HPIL technique was first used over five years ago with the HP 41C programmable calculator and its peripheral products.

That's the simplest HPIL link you can set up, and it only works due to the right software and the right hardware in the HP products.

If you want to connect the HP 110 up to an IBM system you have to do a little more work. The same two wires are used to connect the systems, but a special printed circuit board must first be installed in the IBM machine. Once this has been done, you must load a special HPIL software package into the IBM's main memory. Installing the board is no problem — you just take the system unit cover off and plug the board in.

There are some technical considerations to deal with if you have installed other add-on boards in your IBM system. For example, the HPIL hardware/software combination is loaded into memory at a memory address that is not explicitly occupied by any major IBM routine. However, if any of your add-on boards get there first, you must change a parameter or two in the HPIL software package to avoid conflict.

We found installing the card and software on a bare bones IBM system presented no problems.

Naturally enough, the HPIL software disk does not come with the IBM system files: you have to use your own DOS disk (or use a copy of the HPIL disk with the IBM system tracks and files copied onto it) to first start the procedure. When it has loaded, the screen indicates that the IBM can be set to provide any attached HP 110 with disk access (press 1), screen access (press 2), or printer access (press 3).

The default setting is that the IBM will operate as a disk drive for the portable. Since drives A and B are already assigned to the ROM and RAM memory in the HP 110, external drives begin with the assignment of drive C and go on from there. If the user typed 'dir C:' on his HP 110 while connected to an IBM system, the HP 110 would list the contents of the disk in the IBM's drive A. If the HP 110 was running the WordStar word processing package, it could load a file from the IBM drives or save a file to the IBM drives. If the HPIL software on the IBM is set to the 'printer' option, the HP 110 could use the IBM's printer as if it were its own.

In addition to the HPIL connectors, the HP 110 features an RS232 port to which additional serial devices can be attached, and a 300-baud internal modem with a modular phone jack connector. All the connectors are set along the back edge of the machine, including a direct current power jack and the on/off switch. If the 300-baud modem is not sufficient, you can attach a higher speed version to the RS232 connector externally.

'The HP 110 is compatible with the bigger HP 150 touch screen system, and can make use of files stored on the IBM PC and IBM workalikes.'

Software

Those who read the *PCW* review of the HP 150 (May issue) will be familiar with the PAM system, which was developed as a friendly front-end to MS-DOS. PAM replaces the A> prompt with a menu-like display; all those applications that are currently available via PAM are presented as revese video boxes arranged neatly across the LCD display. A small downward-pointing arrow, or

Technical specifications

Price (in US)	$2995
Size	13in wide × 10in deep × 2⅞in high
Weight	8.5 lbs
CPU	CMOS version of Intel 8086, operating at 5.33 Mhz
ROM	384k; contains MS-DOS version 2.11, Lotus 1-2-3, Memomaker word processor, Terminal Emulation package, Help Text, and Personal Applications Manager (PAM)
RAM	272k; can be split into main memory/ramdisk
Display	80 column × 16 line LCD display. Can produce graphics at a resolution of 128 × 480 pixels. Contrast is adjustable from keyboard
Keyboard	75 keys, eight special function keys. Compatible with HP 150 layout
Modem	Internal 300 baud auto-dial, auto-answer modem included in price
Power	Three rechargeable lead/acid batteries. Batteries can operate the HP 110 for up to 16 hours of continuous use. Automatic shut-down of display to conserve power
Peripherals	HP 9114A battery-powered external disk drive. Uses 3.5in disks and can store up to 710k. The ThinkJet battery-powered ink jet printer

SUMMER MADNESS SALE FROM SCI(UK)

Order Today
Print Tomorrow
24 HOUR DELIVERY

We challenge you to find a better deal!

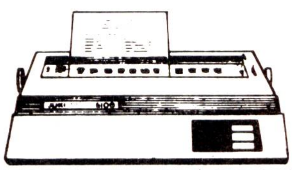
OPEN 7 DAYS A WEEK

EPSON PRICE SPECIALS

EPSON RX80 (DOT MATRIX)	~~£249.00~~	£199 + VAT =	£228.85
EPSON RX80FT (DOT MATRIX)	~~£285.00~~	£229 + VAT =	£263.35
EPSON FX80 (DOT MATRIX)	~~£438.00~~	£324 + VAT =	£372.60
EPSON MX100 (DOT MATRIX)	~~£475.00~~	£355 + VAT =	£408.25
EPSON RX100 (DOT MATRIX)	~~£450.00~~	£385 + VAT =	£442.75
EPSON FX100 (DOT MATRIX)	~~£569.00~~	£499 + VAT =	£573.85

DAISYWHEELS .... at an incredible new LOW PRICE!

JUKI 6100 ....just £329 + VAT = £378.35



20 CPS : BiDirectional & Logic Seeking
10, 12, 15 & Proportional Spacing
Wordstar Compatible
2K Buffer : 13 Inch Platen
Underline : Backspace + Lots more
Centronics Interface Standard

THE DAISYWHEEL THAT HAS NO COMPETITION

OPTIONAL RS 232
TRACTOR AND SHEET FEEDER

WE WILL MATCH ANY GENUINE PRICE ADVERTISED
SCI(UK) IS NEVER BEATEN ON PRICE

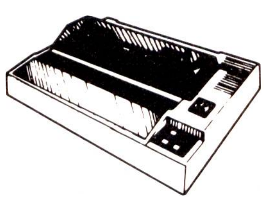
MANY MORE PRINTERS AVAILABLE - 1000's OF SCI(UK) BARGAINS

SEND NOW FOR THE **FAMOUS** SCI(UK) CATALOGUE

for cheapest prices telephone **0730 63741** *or* **0730 61745**

MORE SCI(UK) BARGAINS

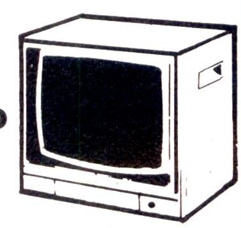
SHINWA CP80 ....£179 + VAT = £205.85



Friction and tractor feed as standard
80 c.p.s.
Bi-directional logic seeking.
13 x 9 dot matrix giving true descenders.
Sub and superscripts.
Italic printing and auto underlining.
Condensed, emphasised, expanded and double strike printing (can be mixed in a line).
Parallel interface fitted as standard.

FIDELITY 14"
COLOUR MONITOR
& COMPOSITE VIDEO

£189 + VAT = £217.35



New from the world famous **CANON** Company

CANON 1080A NLQ DM best value ever at ....**£289.00** + VAT = £322.35

We have interfaces for all types of computers, including CBM 64, VIC 20, APPLE, TRS 80, IBM, BBC, SPECTRUM, QL, etc.

Access · MasterCard · American Express

24 HOUR SECURICOR DELIVERY £9.50 plus VAT ● BANKERS ORDERS, BUILDING SOCIETY CHEQUES, POSTAL ORDERS - SAME DAY
ALL ORDERS COVERED BY THE MAIL ORDER PROTECTION SCHEME ● NATIONWIDE MAINTENANCE CONRACTS ARRANGED
EDUCATIONAL DISCOUNTS VERY WELCOME

Its SUNDAY - Do you realise you can order NOW - We are open 7 DAYS A WEEK.

RANGEKEY LTD. Trading as SCI(UK)

DEALER ENQUIRIES WELCOME WRITE FOR DETAILS

SCI(UK)

SCI (UK) FREEPOST (No Stamp needed)
PETERSFIELD HANTS GU32 2BR

0730 61745
0730 63741

EXPORT ENQUIRIES NO TAX DELIVERY AT COST

Personal callers welcomed. 16. Inmans Lane. Sheet. PETERSFIELD. Hants. TELEX 86626 MYNEWS G

pointer, is used to tell PAM which application should be loaded. Pressing the return key actually invokes the application.

After switching on the HP 110, the system reads all attached disks to look for applications installed under PAM. The system looks for small PAM.MNU files, which are text files containing information about what a set of applications should be called on the menu (WordStar, Lotus 1-2-3), and the MS-DOS command that will load them ('WS' and '123').

At this top level, the eight function keys are assigned the following duties: f1=Start Applic; f2=File Manager; f3=Clock Config; f4=Reread Discs; f5=Datacom Config; f6=System Config; f7=Help; f8=Off.

Pressing f3 results in a screen like that shown in Fig 1. Note that the function key labels have been updated in keeping with the new environment.

Via PAM, HP 110 users can do anything they might be able to if they were using raw applications. There are facilities to create DOS sub-directories via the Make-Dir option, to print or delete files, and to format disks.

The HP 110 can also act as an alarm clock, as all good portables should be able to. Just as the user can create PAM.MNU files to set up menu options, the user can also schedule alarms by creating PAM.ALM files.

These must contain text in the format MM/DD/YY hh/mm message, where MM=the month, DD=day, YY=year, hh=hour of alarm, mm=minute of alarm, and message=the purpose of the alarm (for example, lunch date at 1.30pm).

In most PAM procedures there are system defaults, so the new user need not be concerned about having to go through a complicated procedure just to start work. You can bypass the PAM environment altogether and work with the MS-DOS A> prompt directly. To do this, you select the MS-DOS menu option. To return to PAM, you type 'exit'.

As the Symphony package was not available in time for introduction of the HP 110, it was decided to use Lotus 1-2-3 as the multi-purpose software. Hewlett-Packard promises that there will be an easy upgrade path (probably a ROM chip swap) to Symphony when it is made available.

Using 1-2-3 on the HP 110 is a pleasant experience as it's stored in ROM and all the worksheets are held in the RAM-based disk. Files are saved and retrieved with lightning speed and the whole task of setting up complex spreadsheets is made that much easier.

Similarly, using HP's Memotext word processor is very easy. All functions such as opening, closing, renaming and updating documents are handled by the constantly reassigned function keys. You can even have Memotext edit files, which were created on an HP 110 or an IBM system using WordStar.

Speaking of WordStar, the only curious thing that happened while using this program was the time it took to load initially. On an IBM system, WordStar loads in about six seconds — the HP 110 version took almost twice as long.

Although files can be accessed on an IBM PC, you cannot necessarily run IBM programs on the HP 110. Apart from the code differences, IBM programs address the larger 80-col × 24 line displays and do all kinds of strange cursor movements to achieve particular effects. My attempts to run a couple of IBM database packages on the HP 110 met with a 'Do you expect me to run that?' response. Similarly, trying to run the HP 110 programs (transferred to an IBM format 5¼in disk) only produced a passable copy of the Rosetta Stone on the IBM display.

The terminal emulation software stored in ROM and the built-in 300-baud modem provide an easy method of connecting the HP 110 to larger systems via telephone lines. If a faster modem is used, the user must select the 'Terminal Config' menu option and update the 300-baud rate that exists as a default. Baud rates between 300 and 19200 are possible. The configuration program also allows the user to select other conditions such as whether parity checking should be carried out, whether the end-of-line (EOL) signal is a carriage return or a line feed, and whether data handshaking should be on or off.

I was unable to work with Basic on the HP 110 because the review machine was not supplied with it. The Vanilla Microsoft Basic is now available for the HP 110 and an advanced version is being readied. IBM's BasicA, to nobody's great surprise, will not run on the HP 110.

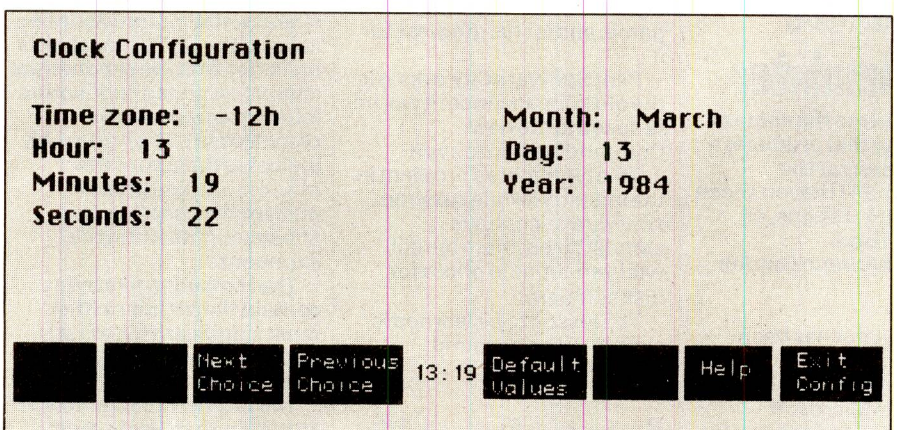


Fig 1 Function key f3: clock configuration

Conclusion

As we were using a prototype, it would be a little rough to make any strong criticisms of the HP 110's robustness.

There were some software problems that on two occasions caused the A: drive — with all the applications stored in RAM — to be overwritten. The only way out was to reformat the disk and load new copies of everything. After the second occasion, however, there were no problems.

Unfortunately, only preliminary versions of the owner's manual were available: there were no manuals for the HPIL interface or any applications.

Despite this, it was easy to work with the HP 110. Its use of function keys helps the new user to start work immediately, and the processing power of the machine makes Lotus 1-2-3 and the like look even better than they do on the IBM generation of systems.

The $2995 price tag is a little expensive for a portable computer, but when you consider what you're getting for the money it doesn't seem too bad — over half-a-megabyte of memory including the bundled-in software, the ability to link up to an IBM-type system and use its resources, plus true portability.

More than anything, the HP 110 is a clear statement by Hewlett-Packard that it intends to get a piece of the personal computer business action. We did not perceive the earlier HP 150 to be a particularly great advance for the company, nor for the computer industry.

The HP 110, on the other hand, looks as though it will not only carve out a niche for itself, but will have its own imitators.

It was not possible to run Benchmarks on the HP 110 as Basic was not supplied with the review machine. END

COMPUTER ANSWERS

Send your queries to Tony Hetherington, PCW, 62 Oxford Street, London W1. Note that Tony cannot answer questions on an individual basis, so please don't send an SAE with your query.

If you go down to the show today . . .

There doesn't seem to be a week that goes by when I'm not inundated with requests, pleas and demands to attend one computer show or another. Most of these invitations are via computer magazines, but occasionally television and radio join in. There is, however, one small omission to their advertising: why should I pay a fortune in rail fares to attend one of these epics?
J Walsh, Loughton, Essex

There are many reasons why you might go to a show.

Firstly, computer shows are an ideal opportunity to meet and talk to numerous people who share the same hobby. This is important, as any hobby that involves hours of sitting at a keyboard can be a rather insular one.

Shows are buyer's market-places where the competition between retailers is so intense that they often have a variety of special offers to entice you to their stand. You also get the chance to see and try a product before you buy.

A wealth of help and advice is also readily available, be it how to solve an adventure problem or which printer to buy for your computer.

A trip to a show can even be profitable: you may find a software house for your new game, or a publisher for your book. At last year's *PCW* show, Melbourne House was busy signing up a hundred new authors.

I'm a feverish collector of show catalogues: not only are they an invaluable source of contacts and phone numbers, they are a still photograph of an ever-changing industry. For example, last year there was no sign of the QL, portable computers were just emerging, and the Apricot and Enterprise had their debuts.

I recommend that you find some time to see some of the features laid on — computer chess competitions, for example, where one program is pitted against another.

Which show you decide to attend is, of course, up to you, but for your information, the next *PCW* show is at Olympia 2 from 19-23 September 1984.
Tony Hetherington

Captured by goblins

While thoroughly enjoying 'The Hobbit', I have reached an insurmountable problem which I have tried to crack for weeks with no success.

I keep getting captured by goblins and thrown in jail. How do I get out? Thorin is with me, but he's no help because all he does is sing about gold.
T Bailey, Oxford

In order that I don't give the game away to those who don't want to know the answer, I'll print it backwards and hope there aren't any typing errors: wodniw eht hguorht uoy yrrac ot niroht ksa.
Tony Hetherington

Commodore flight simulator

Could you tell me the name of any company that produces a flight simulator for the Commodore 64? I haven't seen one in computer shops, or being advertised.
Tony Constantinou, London N10

A flight simulator has been written for the Commodore 64 by the same person who wrote the infamous Microsoft version that's used as a test for IBM compatibility. Consequently, this Commodore version, published by Sublogic, is quite similar. It's to be distributed by Softsel and should be available in most computer shops.

The disk version will cost about £35 but you get a lot for your money. Supporting the disk will be two manuals which take you through basic flying principles to aerobatics. There are also enough navigation charts to keep you flying for hours.

It's supposed to be so realistic that it will teach you to fly. So far, I've learnt how to stall and crash the plane, and consoled myself with shooting down a few Germans in the WW1 flying ace option before the inevitable end.
Tony Hetherington

Shopping around for Zork

I want to buy a copy of the Zork adventure game for my son, who has a Commodore 64. I shopped around and was amazed by the price discrepancies.

The Video Palace in London's Oxford Street told me it was £11.99, but Pilot Software City in Rathbone Place, London W1 is charging nearly £30.

I understand that there are three parts to Zork, so perhaps £30 is a special offer price — it's very confusing. Is this type of price discrepancy common in the computer industry?
B Reynolds, Woking, Surrey

In this case, the price variation is caused by a deal between Commodore and Infocom, the game's manufacturers. Commodore has bought the rights to the 64 version of the game, and is charging less for it.

Pilot Software City's price is the old Infocom price; it will be reduced to the new Commodore figure soon.

This highlights a problem in the industry: while cassette software prices have standardised, there are still wild variations in prices for disk software.

The lesson to be learned is simple — shop around.
Tony Hetherington

Anyone for an IQ program?

I have written a program to measure IQ and other aptitudes. Who should I approach to publish it? Would Bugbyte be interested? Should I send an outline, or will the company require a finished cassette?
N Conway, Rushden, Herts

Bugbyte, Imagine and other large software houses will be more interested in arcade games with their mass sales appeal. They may still consider your program, but I should warn you that they receive hundreds of program submissions every day. I suggest that you approach the book publishers who have dabbled in the software field — Longman, Macmillan, Penguin *et al.* A brief outline will probably suffice, but be prepared to send the complete program should they be interested.
Tony Hetherington

NewBrain 6-byte FP numbers & variable labels

The short answer to 'NewBrain queries' in Computer Answers, *PCW* May gave most of the essential information about the NewBrain FP system, but the examples were too few to give a complete picture and there was one small but important error of fact. The following notes may therefore be helpful.

The first of the six bytes contains the exponential characteristic, stored as a hex value. If the TOP bit is set, this indicates that the exponential characteristic is negative and is being stored as a 256 complement. The bottom bit indicates the sign of the mantissa; it's set if the mantissa is negative, but always counts as 0 in the exponent.

The remaining five bytes contain the mantissa (the most significant byte first), and there are no sign flags in these bytes.

The base of the exponent is 16 (rather than 2 as in most other micros). This explains the very wide exponential range of the NewBrain, as it gives a theoretical magnitude limit of 16 ↑ 126 (approximately 10 ↑ 150). In an FP package using an exponential base of 2, the theoretical magnitude limit is 2 ↑ 127 (approximately 10 ↑ 38).

There is a balancing disadvantage with a hex-based FP system: for a given mantissa length, the system is less precise than if it were based on exponential powers of 2. Put another way, the NewBrain requires a 5-byte mantissa to achieve the kind of precision that can be obtained with a 4-byte mantissa and an exponential

base of 2.

The following examples illustrate the NewBrain system.

Fig 1 covers the range of numbers that the package will store internally. Numbers with exponents outside the range ±99 cannot be entered from the keyboard in simple exponential form, but may be entered in the form of up to 52 digits followed by E±99. 2E150 is entered by typing 2 followed by 51 zeros followed by E99, and E—128 by typing a decimal point followed by 28 zeros followed by E—99. Curiously, it was found that numbers smaller than E—128 (more zeros after the decimal point) could be thus entered, but were found to be stored as six zero bytes and treated as 0. However, numbers with exponents outside the range ±99, though they may be stored and used internally, are not printed out in a useful form. If the decimal exponent is greater than +99, the printout is a line of asterisks, and if the exponent is greater than −99, the number is printed out as 0.

The following program, if typed in *exactly* as printed, will print out the 6-byte code for the variable keyed in in line 10, preceded by two extra bytes which contain the special NewBrain code for the variable name. (The program must be typed in accurately to ensure that the symbol table is located to match the PEEK location in line 30. If the program is modified in any way, this location will become erroneous.)

```
10 INPUT ("Decimal number
   ")AA
20 PRINT"AA =";AA;" is
   coded as"
30 FOR L=0 TO
   7:N=PEEK(32698+L)
40 PRINT N;
50 NEXT L
60 PRINT
70 GOTO 10
```

The variable name may be changed in lines 10 and 20 to any other acceptable NewBrain name (except L or N) without upsetting the printout.

—2E150	codes as	127	9	198	154	151	36
2E150	codes as	126	9	198	154	151	36
—1E99	codes as	85	1	212	42	234	40
1E99	codes as	84	1	212	42	234	40
1E70	codes as	60	1	114	235	173	110
1E30	codes as	26	12	159	44	156	204
—65536	codes as	7	1	0	0	0	0
65536	codes as	6	1	0	0	0	0
—256	codes as	5	1	0	0	0	0
256	codes as	4	1	0	0	0	0
—1	codes as	3	1	0	0	0	0
1	codes as	2	1	0	0	0	0
0.25	codes as	0	64	0	0	0	0
0.05	codes as	0	12	204	204	204	205
0.005	codes as	0	1	71	174	20	123
—1/256	codes as	1	1	0	0	0	0
1/256	codes as	0	1	0	0	0	0
—1/65536	codes as	255	1	0	0	0	0
1/65536	codes as	254	1	0	0	0	0
—1E—30	codes as	233	20	72	75	254	243
1E—30	codes as	232	20	72	75	254	243
—1E—99	codes as	175	139	251	234	118	204
1E—99	codes as	174	139	251	234	118	204
—1E—128	codes as	151	110	232	35	62	66
1E—128	codes as	150	110	232	35	62	66
0	codes as	2	0	0	0	0	0

Fig 1

AA	0	128	BA	37	128	CA	74	128
AB	1	128	BB	38	128	DA	111	128
AC	2	128	■			EA	148	128
■			■			FA	185	128
AZ	25	128	■			■		
A0	26	128	B0	63	128	■		
■			■			IA	40	129
A9	35	128	B9	72	128	JA	77	129
A	36	128	B	73	128	■		
						OA	6	130
						■		
						VA	9	131
						■		
						Z9	192	131
						Z	193	131

Fig 2

The NewBrain method of coding variable names is also very unusual. The two bytes do not contain the ASCII codes for the letters of the name, as would be the case with most other micros: the variable names permitted by NewBrain Basic are coded according to the pattern in Fig 2.

The second byte of each code also carries flags denoting the type of the variable, which in this case is simple numeric. The two bottom bits of the second byte form part of the coded name, and will always be as above. Since the two bytes are in Lo-Hi order, this system is not as illogical as it first appears. The Hi byte has six bit flags followed by two name bits which move through the sequence 00, 01, 10, and 11, as the name itself moves through the alphanumeric sequence given above from AA to Z.

Name and address supplied

Mail order software

I am considering selling my own software by mail order. Is it necessary to have a licence to sell this way, and will I pay tax on the profits?

Could you also give me the address of the Society of Software Authors? I want to register my software and obtain blank cassettes cheaply for duplicating purposes.

A Gourdie, Fife

Here's a number of points that I think you should bear in mind as you plan your venture.

1 You don't, as yet, require any specific licence to operate a mail order operation — you don't even have to form a company. This is a shame, as there seems to be little control over who can sell what to who at what price.

2 Magazine advertising departments (including our own) attempt to ensure our readers' interests by recording details (for example, stock levels) before selling advertising space.

3 You should take a long, critical look at your program and work out how much you would be prepared to pay for it. This is probably the hardest task, as it may mean criticising your own work. However, it's better for you to do it before the press and public do it for you.

4 Consider the machine you are writing for; the popular machines will have a bigger but more competitive market.

5 You will have to arrange funding to buy in cassette stocks: customers will not wait for their game while you wait for enough orders to pay for the cassette duplicating.

Money will have to be found for advertising in magazines. This may be expensive — you've opted for mail order and your advertisements are the only way people will hear of you. If you stop advertising, you'll stop selling.

6 Cassette duplicating is no real problem: there are several companies who will produce cassettes from your master from 35p per cassette, which includes the cost of the blank tape. Obviously, cost per tape varies according to the number produced and the packaging used. A selection of such companies advertise regularly in our Micromart section.

7 Finally, I'm afraid those awfully nice tax people take an interest in all money-making schemes, including your own. I suggest that you talk to an accountant about tax laws. Incidentally, if you're under 16, your father will have to pay some of it, so you should talk it over with him first.

Tony Hetherington

Sharp back-up information

With reference to the 'Sharp MZ-700 software' letter in Computer Answers, *PCW* June, may I recommend 'PEEKing and POKEing the Sharp MZ-700' by GP Ridley.

With regard to the availability of software, Knights, Kuma, Solo Software and David Computer Software all produce a variety of both educational and games software. The relevant addresses are as follows:

Knights TV & Computers
15 Rosemount Place
Aberdeen

Kuma Computers
Unit 12
Horseshoe Park
Horseshoe Road
Pangbourne
Berks RG8 7JW

Solo Software
95B Blackpole Trading Estate West
Worcester

David Computer Software
38 South Parade
Bramhall
Stockport SK7 3B

The MZ-700 series will run both MZ-80A and MZ-80K machine code programs and MZ-80K Basic programs written in SP-5025 Basic.

In view of this, I feel there is no shortage of software.

I would like to complement you on your support and coverage of Sharp machines.

Bill Gill, RAF Gutersloh, BFPO 47

END

Announcing the world's first truly democratic magazine subscription offer...

Continuing PCW's policy of reflecting the interests, views and needs of its readers, we proudly announce the opportunity for you to vote on the burning issue of the subscription price of a year's issues of your favourite micro magazine, Personal Computer World.

Your candidates

To simplify matters, there are three candidate prices for a full year's subscription. They are: a red £15, an orange £15 or a blue £15.

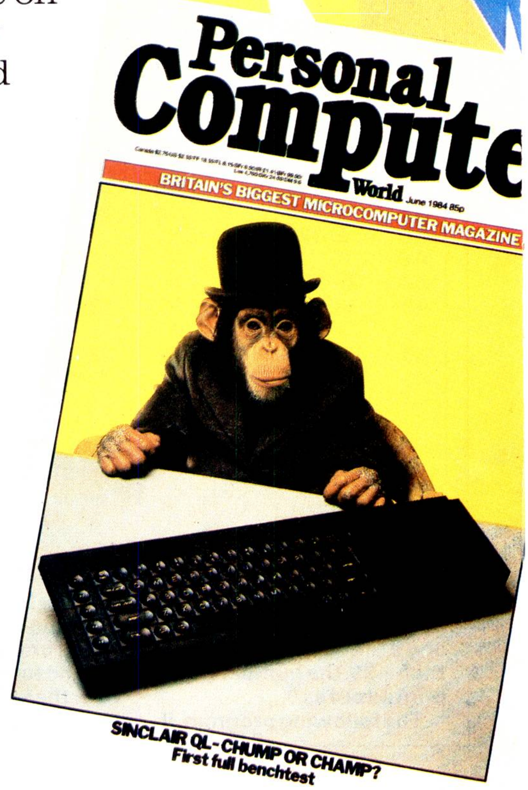
Simply make your vote on the order card (don't worry about the colour) and send it to us, along with your full voting fee (£15).

Your Bribe:

We'll process the vote, and also send you a free copy of our 1984 Benchtests as a thankyou.

Your Leader:

Oh, and you'll also receive a year's copies of Personal Computer World, sent straight to you hot off the press.



NETWORKS

Do you find the world of networks baffling? Peter Tootill, to the rescue, in the battle against 'jargonese'. Plus, some new boards for BBC Micro users.

New boards for BBC users

There are now a few boards around for BBC Micro users. One, called Microweb, is run by *Micro User* magazine. It is a TBBS system and runs 24 hours a day on (061) 456 4157. It should eventually have program listings from the magazine as well as information aimed at the BBC user. Users of other micros are also welcome to call.

The second is run by a shop called the 'Knowledge Computer Centre'. Unfortunately, I don't have the phone number for the BBS ('Bulletin Board System'), as yet, but contact the shop on (0385) 888 144 for the latest information.

The Swedish system is called 'BUG' and the phone number is (010 46 8) 463 528; but, don't panic, English is used.

Wanted—terminal software

A couple of months ago, I promised a list of terminal software for various micro-computers. However, the response to my request for details of packages has been very poor, so I would like to make another appeal for details of any terminal packages. Please address these to me, Peter Tootill, c/o *PCW*.

Calling radio amateurs

A special facility on Liverpool Mailbox is now being provided for radio amateurs.

Called Microwave it includes news bulletins, information from local groups about activities and an area for messages to and from hams.

Microwave is being run by John Fogg (G8UZZ) who will be pleased to receive details of your local club's activities for inclusion in the bulletins. The service is open to all callers, though some parts are restricted to radio amateurs, and others to RSGB members.

New TBBS software

The TBBS system was originally produced for the TRS-80 models 1 & 3, and has proved very popular. It is now available for other machines including the IBM PC, Epson QX10, Kaypro and several CP/M-80 machines. Details from: Beta-Micro Services, 7 Stockville Road, Liverpool L18 3EJ, tel: (051) 428 2733.

Other bulletin board software packages available in the UK are Forum 30, Mailbox 80 and CBBS. The first two can be obtained from Three Line Computing, 3 Endike Lane, Hull HU6 8AG, tel: (0482) 859 169, and the latter from Trevor Smith, 12 Tollgate Road, Hamsterly Mill, Rowlands Gill, Tyne and Wear NE39 1HF, tel: (0207) 543 555. CBBS is for CP/M 80 systems, and the other two are for TRS-80 models 1 and 3.

Network jargon: parity

When information is sent along telephone lines, there is always the danger of interference corrupting data.

To check for this a parity bit is often used. This is an extra bit at the end of the character before the stop bit (see 'Networks', May, *PCW*) which is set high or low depending on the number of high bits already present in the character.

The most common form is even parity: the parity bit is used to make total number of high bits in the character even. The alternative is odd parity where the parity bit is set to make the total number of high bits in the character odd.

An example may help to make things a bit clearer: the ASCII code for the letter 'K' is 75 (decimal) which is 0101010 in binary notation. This has three high bits. To make the total number of high bits an even number, the parity bit will also be set high and the sequence of bits transmitted will be:

```
     7 data bits
   0010101011 ←stop bit
   ↑         ↑
start      parity
 bit        bit
```

The parity method is simply a way of checking to see if any of the information in the character has been changed by interference during transmission. The idea behind it is that the receiving system is able to count the bits and, if the result is not an even number (or odd if using odd parity), then something is wrong.

This very simple system picks up most errors but is obviously not the complete answer. This is because if two bits have been changed in transmission, the parity will still be correct.

There are more sophisticated error checking systems including block check sums used in the XMODEM protocols. These will be covered in a future issue of *PCW*.

UK free networks

CBBS South West . . . Tel: (0626) 890014. Hours: 24 hours daily.

Mailbox-80, W Midlands Tel: (0384) 635336*. Hours: 6pm-8am daily (ring-back system).

Forum-80 Hull . . . (Forum-80 HQ) Tel: (0482) 859169. International electronic mail, library for up/down loading. Hours: 3-11.30pm, Mon-Fri; noon-11.30pm, Sat & Sun (CCITT); midnight-8am, daily (Bell 103).

Forum-80 Users Group, PET Users section shopping list system. Hours: Tues/Thurs 7-10pm; Sat/Sun 1-10pm; nights, midnight-8am, US (Bell 103) standards.

Forum-80 London . . . Tel: (01) 902 2546. Electronic mail, library for down-loading. Hours: 7-10pm weekdays; midday-10pm weekends. Ring and ask for Forum-80.

MG-Net CBBS London . . . Tel: (01) 399 2136. Facilities: electronic mail, program downloading. Hours: Sun 5-10pm.

CCITT Modem Recommendations

Speed Bits/sec	Format: Asynchronous or synchronous	Full/Half Duplex	CCITT Reference	BT Datel Service	Bell Ref.	US Compatible? with CCITT
0-300	A	Full	V21	200	103	No
1200 2400	A&S	H/F	V22 V22bis	1200 —	212A	Yes at 1200b/s
1200 1200/75	A A	Half Full*	V23 V23	600 600	202	Sometimes

*** The Prestel 1200/75 type of service is sometimes referred to as 'asymmetric duplex'.**

NETWORKS

Modem Operating Frequencies

Modem Type	Speed (Bit/s)	Duplex	Transmit Frequency 0 Hz	Transmit Frequency 1 Hz	Receive Frequency 0 Hz	Receive Frequency 1 Hz	Answer Tone Freq Hz
CCITT V.21 Orig	≤300	Full	1180	980	1850	1650	—
CCITT V.21 Ans	≤300	Full	1850	1650	1180	980	2100
CCITT V.23 Mode 1	600	Half	1700	1300	1700	1300	2100
CCITT V.23 Mode 2	1200	Half	2100	1300	2100	1300	2100
CCITT V.23 Back	75	—	.450	390	450	390	—
Bell 103 Orig	≤300	Full	1070	1270	2025	2225	—
Bell 103 Ans	≤300	Full	2025	2225	1070	1270	2225
Bell 202*	1200	Half	2200	1200	2200	1200	2025

Bell 202 has no back channel as such, only a 5 bit/sec on/off signal (387Hz = on, no signal = off) used for handshaking. (CCITT V22 & Bell 212A do not use single frequencies like these and cannot be simply included in such a table.)

Liverpool Mailbox . . . Tel: (051) 428 8924. Electronic mail, downloading, TRS-80 information. Hours: 24 hours daily.

TBBS, London . . . Tel: (01) 348 9400. Hours: daily 9am-7am.

BASUG . . . Tel: (0742) 667983. Hours: 24 hours daily.

Computer Answers . . . Tel: (01) 631 3076. Hours: 24 hours daily.

CBBS Surrey . . . Tel: (04862) 25174. Hours: 24 hours daily.

Blandford Board . . . Tel: (0258) 54494. Hours: 24 hours daily.

Southern BBS. Tel: (0243) 511077. Messages, downloading. Hours: 8pm-2am daily (ring-back system).

NBBBS-North Birmingham . . . Tel: (0827) 28810

TBBS Southampton . . . Tel: (0703) 437 200 (ring-back)

Stoke ITeC (Information Technology Centre) (Remote CP/M) . . . Tel: (0782) 265 078. Hours: 24 hours daily.

Zurich ZZV . . . Tel: (010 41) 1 312 2267. Hours: 7am-9pm daily, and all day Sundays.

Mailbox-84, W Midlands. Tel: (01) 631 3076. Hours: 24 hours daily. TBBS. 300 (V21) and 1200/75 (V23) modes.

UK systems run by commercial organisations, which are free at least in part:

DISTEL. Tel: (01) 679 1888. Run by Display Electronics (new and surplus electronic and computer equipment, components, etc). The system provides information about stock lines, credit card sales, and some message facilities. 300 baud only at present. Cost: free. 24 hours.

REWTEL. Tel: (0272) 236628. Run by *Radio and Electronics World*, the publishing side of Ambit (electronics components suppliers). Information on stock lines, some message facilities,

Business users: £15 per quarter and 5p/minute up to credit card sales; the latter only for subscribers. 300 baud only at present. Cost: limited areas free, remainder £10 pa. 24 hours.

MAPTEL. Tel: (0702) 552941. Run by Maplin (electronic components and microcomputers). Provides information on stock levels, credit card sales to existing customers only. 300 baud only. Cost: free. 24 hours.

ESTELLE. Tel: (0279) 443511 V21 (Datel 200); (0279) 441188 (Datel 600); (0279) 441222 (Datel 1200). For customers of STC Electronic Services. Office hours only.

Subscriber commercial systems in the UK:

PRESTEL. Subscribers only: Prestel consists of a database made up of individual pages provided by many different organisations (not by Prestel itself). 1200/75 baud service at local call rates for a large percentage of potential users. 300 baud service on London telephone number only, at present. Cost: domestic subscribers £5 per quarter and no time charges outside peak periods, 80 per cent of pages are free. 6pm and Saturday mornings, no time charges outside these hours (time charges also apply to domestic users). Information: tel: Freefone 2296.

MICRONET 800. An organisation providing information within the Prestel database specifically aimed at microcomputer users. Service details as Prestel. Cost: £50-£75 joining fee (covers acoustic coupler and software—for a limited range of machines at present) and £8 per quarter on top of normal Prestel charges. Information: Micronet 800, 8 Herbal Hill, London EC1R 5JB. Tel: (01) 837 3699.

Subscriber business systems in the UK:

Commercial systems aimed at business users:

TELECOM GOLD. Info from: Julie Ireland, 42 Weston Street, London SE1 3QD. Tel: (01) 403 6777.

COMET. Message handling system giving user facilities for leaving and retrieving messages: costs £30 per month. Info from: John Douglas, BL Systems Limited, Grosvenor House, Prospect Hill, Redditch, Worcs. Tel: (0527) 28515.

*RING-BACK SYSTEM—dial the number, let phone ring once and then ring back.

American/Canadian networks

TYPE	SYSTEM NAME	NUMBER	NOTES
Forum 80	HQ System	0101.816-861 7040	
CBBS	HQ System	0101.312-545 8086	
FBBS	HQ System	0101.312-677 8514	
ABBS	Ottowa, Ontario	0101.613-725 2243	
ABBS	HQ system	0101.703-255 2192	
MABBS	Fort Walton Beach	0101.904-862 1072	
Bull-80	Alabama	0101.205-492 0373	
Conn-80	Colour Computer	0101.212-441 3755	colour graphics for TRS-80 Colour

European networks

ELFA	ABC-MONITOR Sweden	010.468 730 0706	Half duplex
ABC-Banken	Halmstadt, Sweden	010.463 5110771	
ABC-MONITOR	ABC Club of Sweden	010.468 801523	Passwords required
CBBS	Gothenburg, Sweden*	010.463 1292160	75/1200 baud
		010.463 1690754	300 baud
	Helsinki	010.358 0722272	

*After receiving the tone and connecting your modem, either type <C/R> or type: <COM C/R>. The system then asks for a password which is: 'cbbs' *in small letters*!! If you only get '>' when you dial up, the system needs resetting and you type <I> C/R.

SOFTWARE

Friday!

Ashton Tate's Friday! aims to provide simple facilities in a simple manner. Is it on target and is there an easy upgrade path to the company's more powerful dBaseII? Kathy Lang reports.

Ashton Tate's data management package dBaseII is still, despite its age and, according to some users, unfriendliness, the market leader. But a good many users do not need the power and flexibility of dBaseII, nor are they prepared to pay £438 for such a package. Ashton Tate has now brought out a data management package called Friday!, aimed at meeting the needs of those who do not need the full power of dBaseII, but who do want straightforward facilities provided in a manner which is very easy to use. At £195, it is competitively priced but how far does it meet the aim of providing simple facilities in a simple manner?

Friday! is a menu-driven system with a reasonably clear structure, and one unusual and highly desirable feature: at almost every stage, it is possible to end your current task and get straight back to the main menu without having to backtrack through several layers. Friday! uses fixed format, fixed length records, so the maximum necessary space is used to store each record regardless of the actual amount of information it contains. A reasonable variety of functions is provided including a simple letter-writing facility. Files can be read by dBaseII, but if they are altered it may be necessary to re-index the file when you next use it.

Friday! can only handle one file of records at a time, although you can use a second file to 'look up' values which regularly recur in order to avoid storing repetitive information (Fig 1).

The major limitations on records are that they may contain no more than 32 fields, and character fields may be no longer than 32 characters. ('Look up' fields, whose values are recalled by looking up the value entered in another reference file, may be up to 60 characters long.) This makes Friday! inappropriate for applications involving text, such as library catalogues. Three types of data field are allowed: you can store items as numbers (called Math fields — ugh!), characters (called Anything) or Logical (containing the values Yes or No). Numeric fields (which may be whole numbers or contain a decimal point) are entered from the keyboard or calculated by Friday!, either at data entry or subsequently.

The first step in setting up a file is to tell Friday! the name, type and length of each item of information in the records. In addition to the conventional data types of character, number and logical item, you can have 'look up' fields. These involve entering an abbreviation for a field, which is filled from a separate file containing a list of abbreviations and their full forms. This feature can be used to ensure that only valid values are entered for a data item, and also as a substitute for two-file processing in some circumstances. Supposing you have a list of products, many of which come from the same supplier; you can avoid having to keep the supplier's full name and address in every relevant product record by storing in the product record a short code

Maximum file size	OS Limit	Data validation	Average
Max record size	999 chars	Screen formatting	Col and row entered
Max no. fields	32	Unique keys	No
Max field size	32 chars	Report formatting	Col and row, Letters
Max digits	10	Save calculated data	Input, update
Max prime key length	64 chars	Totals & statistics	T+ST
Special disk format?	No	Save selection criteria	Mandatory
File size fixed?	No	Combining criteria	And, Or, Not
Link to ASCII files?	Yes, various	>1 criterion/field?	Yes
Data types	Numeric, Char, Logic	Wild code selection?	String Within
Fixed rec structure?	Yes	Browsing methods	Any Field
Fixed record length stored?	Yes	Interaction methods	Menu
Amend rec structure?	By copying	Reference Manual+	***
Link data files?	No	Tutorial Guide+	*****
No. data files open	NA	Reference Card+	****
No. data files open	5	On-Line Help+	****
No. keys	1	Hot-line?	Dealer support
Max key length	64 chars, 5 fields		
Subsidiary indexes kept up-to-date?	NA		

Fig 1 Features and constraints

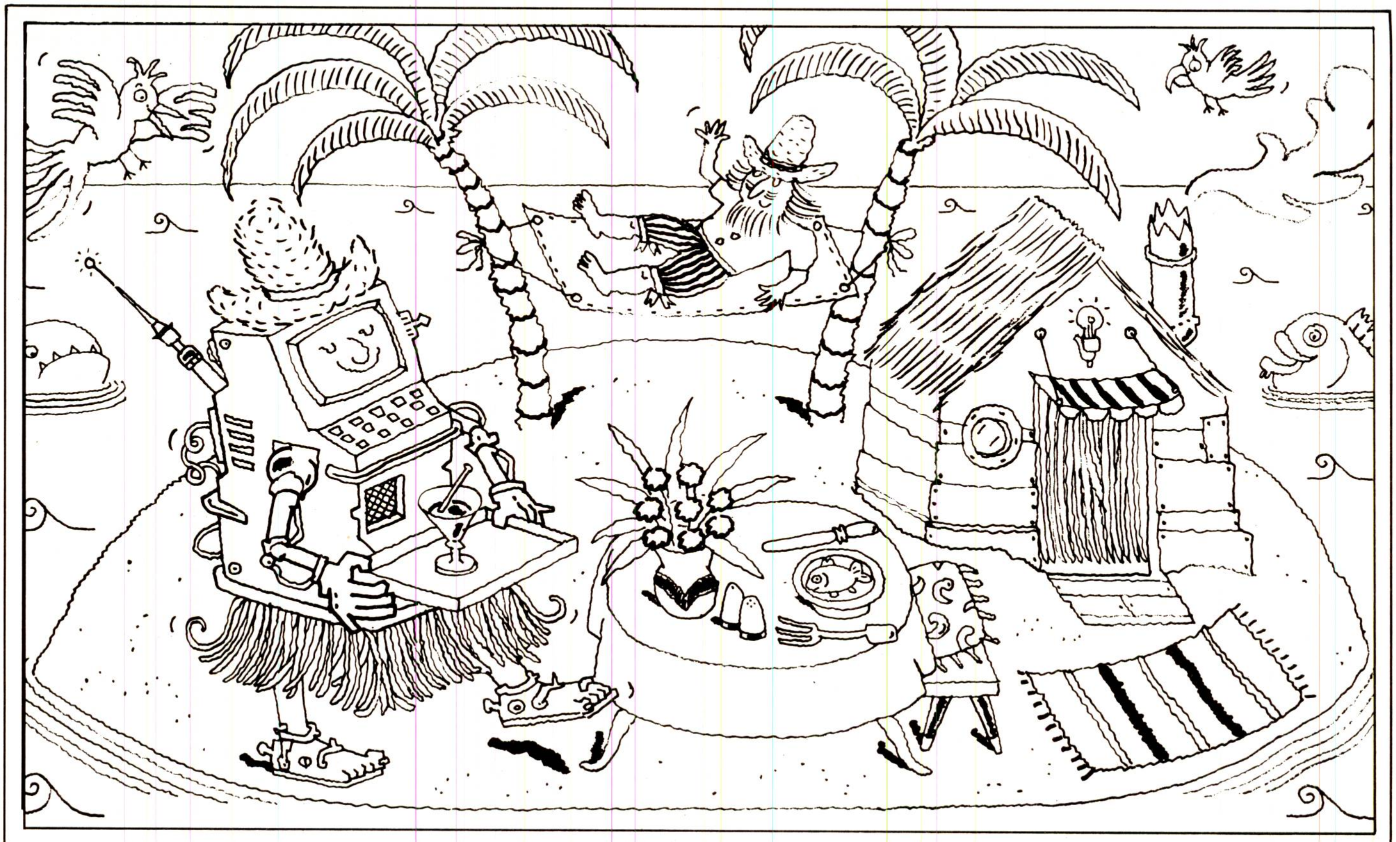


Illustration by Chris Winn

for the supplier's name and address, and storing just one copy of the full version of the information in a reference file, which is looked up whenever the product record is retrieved.

Unless you request otherwise, the first field in the record will be used as the 'primary key' — that is, it will be used to determine the order in which records are stored, and to allow fast retrieval of individual records. You can ask for several fields to be used to order the file (name within department in a personnel records system) but only the first that you specify is available for fast retrieval through the 'quick search' facility.

Once the record format has been set up, Friday! will then create a 'default' format for displaying it on the screen. You may use this, or create one or more formats of your own (up to 15 for any one data file). The record format can be changed to add or delete fields or amend data types within Friday!. Although this involves Friday! in copying the data, it is done without you having to worry about the mechanics, except to allow enough space on the disk to enable the copy to be made. If you want to change field names, you must copy the Friday! file out to a text file and copy it back.

Entry of records is carried out by entering one record at a time on the screen, with full control over cursor movement using the same keys as those used by WordStar. To amend records, you can use the 'quick' search technique with the key, or set up a retrieval rule to select on other fields. When using the key, you get all fields starting with the characters you enter: for example, entering 'Johns' will get you all the Johnsons and Johnstones, too. However, this does mean that you need type only the minimum characters necessary to ensure you find the right record. Whether searching with the index or sequentially, you can restrict the search to a particular range of records, and if it will speed things up to utilise the order into which the file is sorted, then Friday! will do so. When records are deleted, they are simply marked for deletion and may be 'undeleted' until the records are finally purged.

For each file, Friday! automatically creates a screen format called 'Fridayform' which displays all the fields in the record on a single screen. If you prefer, you can design your own screen layouts; you may have up to 15 for any one data file, and these need not all contain every data item. The process of format design is quite straightforward in all respects save one. You are shown a grid representing the layout being designed; you then input the column and row for each field in turn, and these are entered on the grid. For each field, you may also enter a 'typing guide', which allows Friday! to do some validation on the value being entered. For instance, you can specify that a character field is actually to be two letters followed by three digits, or that a numeric field to be used for currency may contain no more than two digits after the decimal point.

The real advantage with the Friday! approach is that if you decide you need to amend the layout of a field, you have to re-enter it completely — you can't edit the format. Worse still, you can only re-enter or delete a field if it's the last one you entered. To erase an earlier field format, you must erase all the ones between the most recently entered field and the one you want to change or delete, and then re-enter all the field formats that were correct as well as the format in error!

In addition to screen formats designed for showing complete records, any report can also be displayed on the screen provided it occupies no more than 20 lines per record.

Printed reports

You may design up to 15 report formats for each file, which may use either the Quick format or a more sophisticated Custom format. The Quick format allows you to specify the items you want to include, the column start, and width for each item. Items may be fields, text, a combination of the two, or expressions combining numeric fields or constants. You can also specify the number of lines per page, whether totalling and sub-totalling is required, and whether a summary or full report is required. The summary report gives totals and sub-totals only. I couldn't persuade Friday! to give me a summary report just showing totals without utilising the sub-total facility. Sub-totals are shown for each numeric field when the value of a single field changes — it's not possible to have more than one controlling field for sub-totals.

Custom reports are intended to give you greater flexibility over report layout. They enable you to set up more flexible columnar reports, and also provide a primitive standard letter format. I say primitive because the way in which the letter is entered obliges you to worry about line widths and endings — no fancy wrap-around facili-

ties here. Each item to be printed has a number, column and line number to allow you to print several items on one line. These numbers, and the field names or text, are entered in a table on the screen. As the table only allows 50 characters for each item, in order to print a line of text longer than fifty characters you have to enter two items — one containing the first 48 characters (delimited by quotes) and the second containing the rest of the text line. The example given in the manual is shown in Fig 2 — you can see just how clumsy it is. Certainly it's not easy to find a way to make it simple for the casual user to enter such letters, but surely Ashton Tate could have done better than that!

Report formats of both kinds can be edited, so they may be tried out and then amended to suit. There is a special label-printing feature which allows you to specify the format of your own labels: for instance, labels mounted up to four across the page are permitted. When you come to print your report, Friday! asks you to confirm that the printer is ready before going ahead — a helpful feature. On the other hand, if you abandon printing in the middle, you are returned to the operating system to restart (though no data is lost).

When displaying records on the screen for browsing to view or edit, or when displaying or printing reports, Friday! allows you to set up a retrieval rule which limits the retrieval to records which match the rule. You can have up to 15 such rules stored at any one time for each file. A rule may contain up to 60 characters and consist of field names, constants, comparison operators such as <, > and special operators such as $ (used between two strings to test if the first is contained within the second).

Elements in a rule may be combined with AND, OR and NOT, and brackets may be used to ensure the correct order of evaluation. The syntax of the rule provides an unusually powerful selection tool compared with other packages in Friday!'s part of the market. The scope of the rule may be limited to particular sets of records, on the basis of either the record number (a number assigned to each record in ascending entry sequence), or of the value of the primary key. So, if your invoices are stored in date order and you know that all those you want to process lie between two dates, you can restrict the search to those dates and save a lot of time.

Friday! 'sorts' by producing an index of the fields being used to determine record order and sorting it, a process which is normally much quicker than sorting the whole file, and also saves you having to allow a lot of spare space on your data disk for sort work files. Permanent ordering is achieved by specifying that one or more fields (up to five) should be used to determine the order in which records are to be displayed or printed. If you want a particular report shown in a different order, a temporary sort can be done for that purpose.

Fields are calculated at data entry for storage in the record; this is achieved by attaching a calculation to the field. You can also amend a field definition to attach a calculation to it later, and if you do so Friday! will amend all the existing records accordingly. This feature could be used to raise all prices by 10%, or reset dates in some accounting applications. You can also print the results of calculations in reports, by including expressions as report items.

Only one file can be manipulated at a time (excepting the look-up file facility, which can be used in data entry and in reports). If you need more sophisticated facilities, including tailoring tasks to your specific needs, you can use Friday! files within dBaseII. Friday! uses the same data and index file formats, so you can access files and manipulate them as if they had been created within dBaseII. The manual warns against amending record order within dBaseII, as this could make it necessary to rebuild the index on returning.

Security & reliability

Friday! uses two levels of password: one on the whole system and the other on individual data files. As to reliability, I had only one small problem when I was creating a Quick report. To do this, you first make any necessary changes to the values provided for printing options (paper length, and so on) and state whether you want totals and/or sub-totals. Then you design the report layout. At any stage during the design step, you can save the report format and edit it later. When I tried this, I was interrupted in the middle and saved the format before I'd entered anything into

Item	Line	Column	Contents
1	21	15	[TRIM(FIRST:NAME)+" "+LAST:NAME]
2	22	15	[ADDRESS]
3	23	15	[TRIM(CITY)+" "+STATE+" "+ZIP]
4	26	15	["Dear New Client,"]
5	28	15	["Thank you for placing your rental home with Fant"]
6	28	63	["asy"]
7	29	15	["Inc."]
8	31	15	["It has been added to our listings, and your home"]
9	31	63	["is now"]
10	32	15	["being offered selectively around the world. Wit"]
11	32	63	["h all"]
12	33	15	["its amenities, I'm certain that we'll have no"]
13	34	15	["difficulty in locating the right kind of tenant"]
14	34	63	["for"]
15	35	15	["your home."]
16	37	15	["If you have any question, or if we have overloo"]
17	37	15	["ked"]
18	38	63	["anything in the attached listing, please don't"]
19	39	15	["hesitate to call."]
20	41	15	["I'm looking forward to working with you."]
21	44	15	["Sincerely."]

Fig 2 Custom report table

Benchmarks

BM1	Time to add one new record	2secs
BM2	Time to select record by primary key	6secs
BM3	Time to select record by secondary key	NA
BM4	Time to access 20 records from 1000 sequentially on 3-character field	13secs/rec
BM5	Time to access record using wild code	14secs
BM6	Time to index 1000 records on 3-character field	14mins 47secs
BM7	Time to sort 1000 records on 5-character field	12mins 24secs
BM8	Time to calculate on one field per record and store result in record	6mins 55secs
BM9	Time to total three fields over 1000 records	2mins 20secs
BM10	Time to add one new field to each of 1000 records	19m 30secs
	Time to import a file of 1000 records	8mins 20secs

the design step. When I came back and edited the design to try to add some fields, Friday! crashed with a fairly incomprehensible message and left me back at the operating system level. This was more of a nuisance than a disaster, as I simply started another report and did the design all in one go. But it had me worried until I'd pinned down exactly what was happening.

Friday! can import and export text files; records may be fixed format or may contain fields delimited by commas. The normal file format is the same as that used by dBaseII and can be read by that package.

Files can be copied and deleted. You can also get a directory of appropriate groups of files at any stage, so you don't have to remember file names. The package uses very sensible rules to decide which file should be the 'default' in any particular situation, but you can always override this.

User image

In the main, I thought the approach taken by Friday!'s designers an excellent compromise between verbosity and ease of use. To get to the right part of the package, you use menus; once there, available options are usually shown on the bottom two lines of the screen, so it's possible to use the package virtually without reference to the manual once you have a grasp of its capabilities. If you do need to refer to the manual, your task is made much easier by the fact that on each screen a number is displayed, linking the screen with an explanation in the reference section of the manual.

The defaults used are generally sensible, and you can also change options easily. Confirmation is required only for actions where it would be a real nuisance to make a mistake. There are some good, unusual touches: for instance, when setting up a new file, Friday! displays in the top right-hand corner of the screen the number of characters available for the record — 999 at the start — and decrements this as each field length is entered. The same technique is used whenever the user runs into Friday! constraints (when setting up rules and calculations, for example). When you have finished with a particular task, you always have the option of moving either to the previous menu or to the main menu.

There are, however, a few unfortunate features: the inability to edit a screen format fully, which obliges you to delete several correct field formats in order to correct an early error, is a real pain. It should be possible to abort printing without leaving Friday! altogether, and the report format used to create standard letters is very crude. While these drawbacks are a nuisance, they are quite small problems set beside the mainly excellent features of Friday!'s user image.

Documentation

This comes in two main parts: a tutorial guide to all the basic features, and a reference list of all the screens documented in numeric order. There is also a 'road map' which indicates the range of functions available, a glossary of terms, an index, and a set of 'standard operations'.

The tutorial guide is excellent — a bit chatty for my tastes, but I expect that's just my personal reaction to our US cousins' tendency to folksiness. It uses example files supplied with Friday! to introduce you to each main feature in turn, giving enough information to encourage further exploration without blinding you with detail.

For more information, you use the screen prompt numbers to check the reference manual, which is quite clear too. To carry out a particular task (one of the 'standard operations', for example), you can use the Friday! documentation to help you (see Fig 3, which shows the steps needed to create a mailing label). Note the prompt number beside each step in the operation.

So far, so very good indeed. The difficulty comes when you want to do something which isn't included in the standard tasks, and you can't find anything relevant in the index. As the 'road map' does not show prompt numbers, it becomes difficult to find out exactly where a particular feature is documented in the reference manual. Usually, the best way is to get Friday! going, use the road map to find the part of the package you want, and use the screen numbers to check out what is necessary. Browsing through the more complex features would be much easier if the road map contained references to screen numbers.

Conclusion

Friday! is a straightforward data management package providing basic facilities in a simple way. Provided your records have a simple structure and do not contain long fields, Friday! should provide enough features to satisfy most ordinary data manipulation requirements. If you do need further sophistication, you can graduate to dBaseII and use it on Friday! files.

The package is well designed, apart from a couple of minor wrinkles, and documentation is excellent: it would be even better with the addition of screen prompt numbers to the 'road map'.

At £195, it represents very good value for money. END

Prompt	Title	Selection	Entry
006	Main Menu	B-Retrieve Data	[B]
200	Retrieve Data	E-Mailing Labels	[E]
200	Retrieve Data	Enter any letter if you don't want default listing	[Z]
009	Data Files	C-Choose a Data File	[C]
013	Data Files	Choose a letter	[ ]
009	Label Format	A-Create	[A]
012	Label Format	Enter Name and Description for your new Label Format	
500	Design a Label	Refer to Prompt 500 instructions to design your label	
500	"	S-Save	[S]
507	Design a Label	Please Confirm that you want to save the label	[Y]
600	Search Menu	<RETURN> to Search	<RETURN>
510	Labels	S-Set up	[S]
		Refer to Prompt 510 to change settings	
510	Labels	T-Test Labels	[T]
		P-Print Labels	[P]
502	Design a Label	Add this field to which line 1..5	[ ]
504	"	Jump	[ ]
505	"	Clear Restart which label line	[ ]

Fig 3 Creating a mailing label

Summary

Package Type	Suitable for novice users needing basic data management facilities
Strong Points	Powerful selection facilities; good display and report features
Drawbacks	Single file only; crude method of setting up standard letters; limited direct access to records
Ease of Use	Excellent
Error Messages	Mostly helpful
Documentation	Excellent
Costs (ex-VAT)	£195
Supplier	Ashton-Tate, Cofferidge Close, Stony Stratford, Milton Keynes MK11 1BY, tel: (0908) 568866

Advance 86

There is a noticeable trend in favour of home micros which can be turned into business machines — the BBC Micro and Amstrad to name but two. Unfortunately, they are better suited to home and hobbyist use. The Advance 86 is a home micro which can be upgraded to an IBM PC-compatible — does it make the transformation smoothly? Surya tests it out.

The Advance 86A is a home micro which can be upgraded to a fully-fledged IBM PC-compatible. For £400, you get a 128k micro with IBM cassette Basic and high resolution colour graphics. For an additional £1100, you can upgrade to an 86B — a PC-compatible with twin floppies.

The Advance upgrade path is not cheap — by the time you've added a monitor it's nearly the cost of a PC — but the result is what Advance claims is a 100% compatible machine at the end of it.

The Advance is sold exclusively through the WH Smith chain.

Hardware

The model A (the home system) is housed in a black plastic box measuring 52cm × 39cm × 15cm. Opening a hinged perspex cover at the front of the machine reveals the detachable keyboard. This slides out in front of the machine and is connected to the main unit via a coiled cable. An illuminated power switch sits above the keyboard socket.

The keyboard is a cheap copy of the PC keyboard. The layout and markings are almost, but not quite, identical. All the PC keys are provided, although the minor difference in layout is annoying if you're used to typing on the PC keyboard.

In the feel of the keyboard, however, there is all the difference in the world. The PC keyboard easily rates as my personal favourite, having a sharp and 'clean' feel. The Advance keyboard, in contrast, feels dull and unresponsive. I expect a better quality keyboard on a machine costing £400; on a £1500 business system, I would find the Advance keyboard unacceptable.

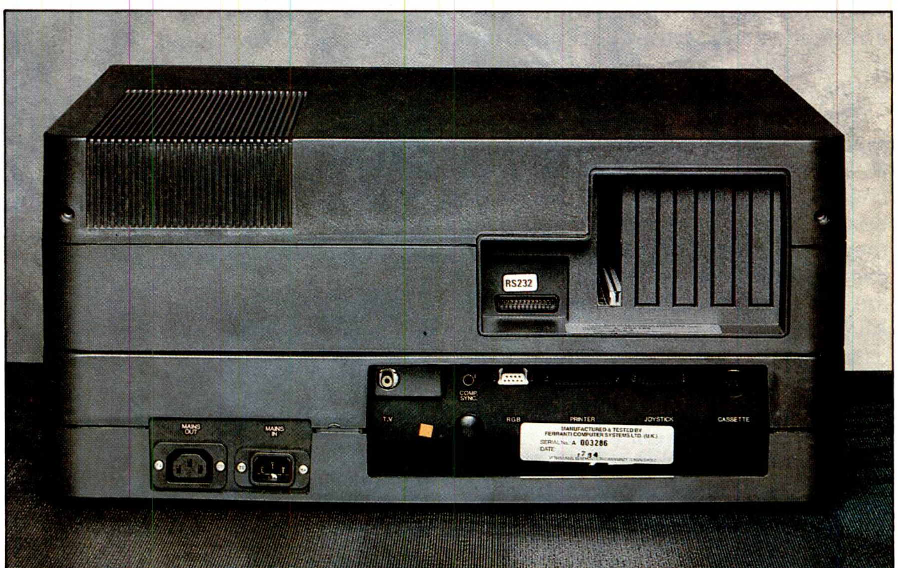
At the rear of the machine are — from left to right — sockets for TV, composite video monitor, RGB monitor, centronics printer, single joystick and cassette player. No serial port is provided on the Model A.

Getting inside the machine is simply a matter of removing six screws and lifting off the top of the casing. Inside is one of the neatest layouts I've ever seen in a machine of this price. Everything is contained on a single board, with the power supply unit alongside. Because of the size of the board (30cm × 30cm) it cannot be placed in the bottom half of the casing: that space is reserved for the keyboard. Instead, it sits upside-down in the top half of the casing.

The board's layout is impressively tidy. Fourteen of the 84 chips are socketed (primarily the Ferranti ULAs, of which there are no less than nine) and the 8086 processor. All the components are marked and given adequate space. A couple of patches are visible, but nothing major. 128k RAM is soldered onto the board together with 16k video RAM, and sockets are provided for an additional 128k.

The processor is an Intel 8086, rather than the 8088 used by the PC. The 8086 was the first 16-bit processor to be developed by Intel and has a 16-bit data bus, while the 8088 uses an 8-bit one. Given the same clock speed (4.77 Mhz), the '86 may be up to 30% faster in execution than the '88, and this seems to be confirmed by the Benchmark timings.

The keyboard is 'dull and unresponsive'



Rear view (no serial port on the Model A)

Both the 8086 and the 8088 are designed to be able to operate in a multi-processor environment. A popular arrangement is to fit an 8087 maths co-processor. In numeric operations this will typically improve execution speeds by around 100%, so is a worthwhile investment for anyone who needs fast number-crunching. The Advance, like the PC, has a socket intended for the 8087.

Most of the support chips are identical to those used in the PC.

The disk system

The prime selling point of the Advance is its ability to upgrade to a fully-fledged PC-compatible business system. The upgrade, known as the 86B, is supplied in the form of a clip-on unit which sits on top of the Model A and costs an additional £1100.

The Advance disk system is a great, hulking brute of a machine which isn't portable by any stretch of the imagination.

The unit contains two slim-line Shugart disk drives and an RS232 port in a casing measuring 52cm × 39cm × 15cm. With the unit clipped on top of the Model A, the complete system begins to look decidedly overbearing — especially when placed alongside an Apricot as it was when I wrote this review! Put a monitor on top, and you won't have any more problems reaching the top shelf in your office.

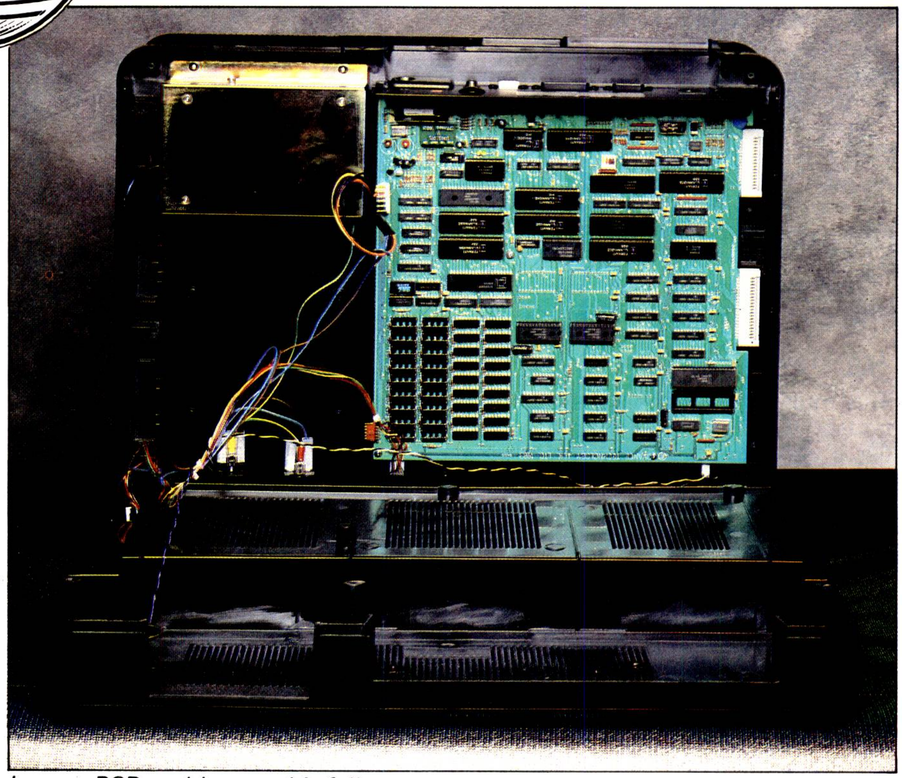
Inside the Model B is a larger PSU, the two disk drives, disk control circuitry and a motherboard. The motherboard has four PC-compatible slots and two additional 'true 16-bit' slots. The 8088 uses an 8-bit data-bus, so the expansion boards have an 8-bit architecture. With the 8086, however, 16-bit expansion boards may be used, and it's for these that the two extra slots are provided. Only four, rather than five,

PC-compatible slots are provided, as provision for an additional 128k RAM is made on the main PCB. On the PC, the 128k RAM board occupies one of the expansion slots.

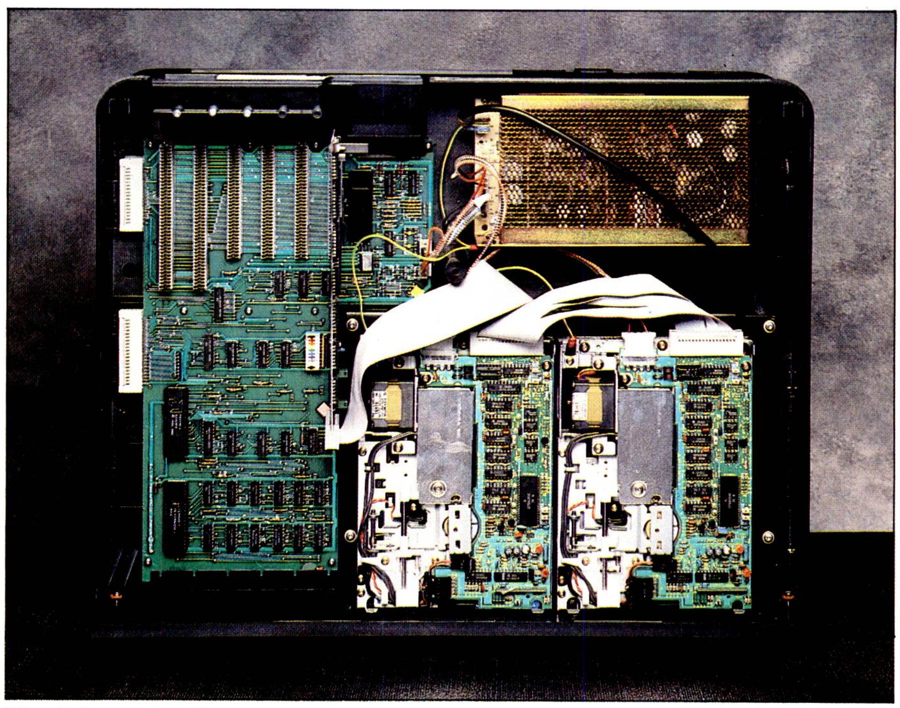
Taking the disk system apart is no easy task. The two units have to be carefully unclipped, the top and bottom panels unscrewed and removed, the hinged keyboard cover removed, the power supply connecting the two boxes unplugged, and two connecting ribbon cables unclipped. The process involves balancing the Advance on its side and the undoing of a great many screws. Putting it all back together again is even worse! Fitting expansion boards is no better: you have to cut out a piece of thick plastic — a process which took me ten minutes with a Swiss army knife and cost me a cut thumb into the bargain. Score nil for ease of servicing.

The neatness of the layout inside the machine is spoilt both by the difficulty in dismantling the system and the cheap plastic casing. The expansion boards didn't fit properly in the slots if they were screwed to the side of the casing, and the ventilation is inadequate — parts of the casing grew very hot. All in all, I got the impression that the casing had been something of an afterthought.

Space is provided within the casing for the addition of either two further floppies or a winchester. According to Advance, an internal winchester will be available by the time you read this, but any PC-compatible external winchester can be used.



Inverse PCB could cause chip fallout



The 86B — note blood-stained expansion board

Software

The Advance 86A, like the PC, is fitted with IBM cassette Basic in ROM, except that on the Advance it calls itself Advance Technology Basic Ver 1.0. This is a comprehensive and powerful cassette-based Basic interpreter. There will also be a Welcome cassette which I haven't seen.

The 86B was supplied with an operating system called Advance DOS 2.11 which behaves remarkably like PC-DOS 2.11. The disk-based Basic, BasicA, is again identical to the Basic of the same name on the PC.

Advance DOS 2.11 had one major bug. When the DOS booted from a cold start, it checked the amount of RAM present. If it had 256k, it duly noted this and allowed users to run packages requiring this amount of RAM. When it booted from a warm start, however, it didn't bother to check its memory, simply assuming that it had the default of 128k. If you tried to run something like Lotus 1-2-3, it complained that it didn't have enough memory and refused to run the program.

DOS 2.11 has now been replaced with 2.13 (what happened to 2.12 is anyone's guess) which does check its memory after a warm boot.

Also supplied with the 86B is a set of four Perfect Software packages: Perfect Writer, Perfect Speller, Perfect Filer and Perfect Calc — these are described as having a retail value of £750. I must admit to being a little sceptical as to the retail price, as every time I've come across the packages they've been supplied free with something! The only Perfect Software package I like — the communications package, Perfect Link — is not supplied. Such is life.

There is a wide selection of PC software to choose from, including the industry standards like WordStar. WH Smith is planning to stock a limited selection of PC software — the list I was given mentions WordStar, Multiplan, dBase II, Zargon III (a chess program), Flight Simulator, and something called 'In Search of Amazing Things'. Other programs can be ordered from the full range of IBM software.

IBM Basic

BasicA, the disk-based Basic, is also known as GW ('Gee Whiz') Basic. The cassette-based Basic is a slightly less powerful subset of BasicA — the main differences are that BasicA supports more powerful graphics statements like CIRCLE, DRAW and PAINT.

GW Basic is powerful, pleasant to program in and has all the features you'd expect from a modern Basic interpreter. Like the DOS, the version of BasicA originally supplied with the Advance proved faulty and has now been replaced with a corrected version.

Compatibility

The acid test of any so-called compatible is to feed it something which relies heavily on the rather strange IBM screen addressing. A classic example is the Microsoft Flight Simulator — I tried it and found that I can crash every bit as quickly on the Advance as on the PC.

There was plenty of PC software lying around the office; the Advance ran everything I threw at it bar one package — a database program which hung the system but ran perfectly on a PC.

On the hardware side, the score sheet was not so good. We only had three PC boards in the office: of these, one worked, one didn't and the other convinced the Advance's diagnostic routines that it had a processor failure. Talking to Advance, it seems that the DIP switches may need to be set differently, but the company was unable to suggest possible settings.

The Advance ran the *PCW* Benchmarks significantly faster than the PC, due presumably to the faster processor.

As a soak test, I left it running two FOR-NEXT loops inside a GOTO loop. It looped away happily for 24 hours without complaint, though it did get rather warm.

If anything goes wrong with the 86A, it is returned to the branch of WH Smith where it was bought and it will apparently be repaired and ready for collection within 48 hours.

In the case of the 86B, WH Smith recognises the need for a quick response to breakdowns. The company has signed a maintenance contract with National Advance Systems, providing on-site maintenance with a response time of eight working hours. This service is provided free of charge during the first 12 months.

One worrying point is that all technical queries regarding the Advance are referred to WH Smith, rather than being handled by Advance. I mean no slur on WH Smith's computer store assistants, but in my experience they appear to be trained to answer The Ten Questions Most Commonly Asked About Computers, and have no real understanding of the products they sell. This is fine for Spectrums and the like, but I do feel that a one-day computer training course hardly qualifies a salesperson to give advice and support on a business system, despite reassurances from WH Smith about further 'on the job' training.

Documentation

The documentation comprises a single A5 manual which attempts to cater for both the 86A and the 86B.

There is no Basic tutorial, so those new to Basic will have to buy one of the various IBM Basic tutorials available. A Basic reference section is provided for those already familiar with another dialect of Basic, where most of the BasicA-specific statements are explained in sufficient detail.

The DOS commands are explained adequately to someone familiar with some form of operating system, going into reasonable detail on other, more powerful commands. The DOS section is perfectly adequate in explaining what to do and how to do it, but doesn't explain why certain commands should be used. I think many beginners will be left asking: 'I see how you do it, but why would you want to?'.

The hardware section is totally inadequate, telling you how to use the keyboard and very little else.

Prices

	£
Advance 86A	399
Upgrade to disk system (86B)	1099
86B disk system	1499

All prices include VAT. The Advance is available only from WH Smith 'computer store' branches.

Conclusion

I would not recommend the Advance 86B to someone looking for a PC-compatible. It's grossly oversized, the casing is poorly constructed and the keyboard is appalling for a supposed business micro. Fitting expansion boards is inconvenient if not downright dangerous!

Pricewise, an IBM PC with monochrome monitor will set you back just over £2030 including VAT. The Advance 86B costs £1500 plus the cost of a monitor — a saving of £300-£400. The PC, however, is solidly constructed, offers the support of an established company and is the only machine *guaranteed* to be 100% PC-compatible!

Benchmarks

Benchmark programs run using BasicA.

BM1	1.1
BM2	3.5
BM3	7.5
BM4	7.6
BM5	8.3
BM6	14.9
BM7	23.2
BM8	26.1

All timings in seconds. For a full listing of the Benchmark programs see 'Direct Access'.

There are a large number of PC-compatibles to choose from. Most of them cost more than the Advance, but I think this just reflects the truth of the adage that you get what you pay for.

The question of support is also an important one when you're considering a business micro. While the 12-month on-site maintenance contract is reassuring, the fact that technical queries are referred to WH Smith is less so.

The 86A is, I think, worth a closer look as a hobbyist machine. My criticisms of the casing and quality of the keyboard still apply and you're going to need a pretty large desk, but it does offer some attractive features. The 128k RAM, expandable to 256k, is appealing, as is the Basic: GW Basic appears to have become the *de facto* replacement for MBasic, and IBM cassette Basic offers a reasonable subset of this.

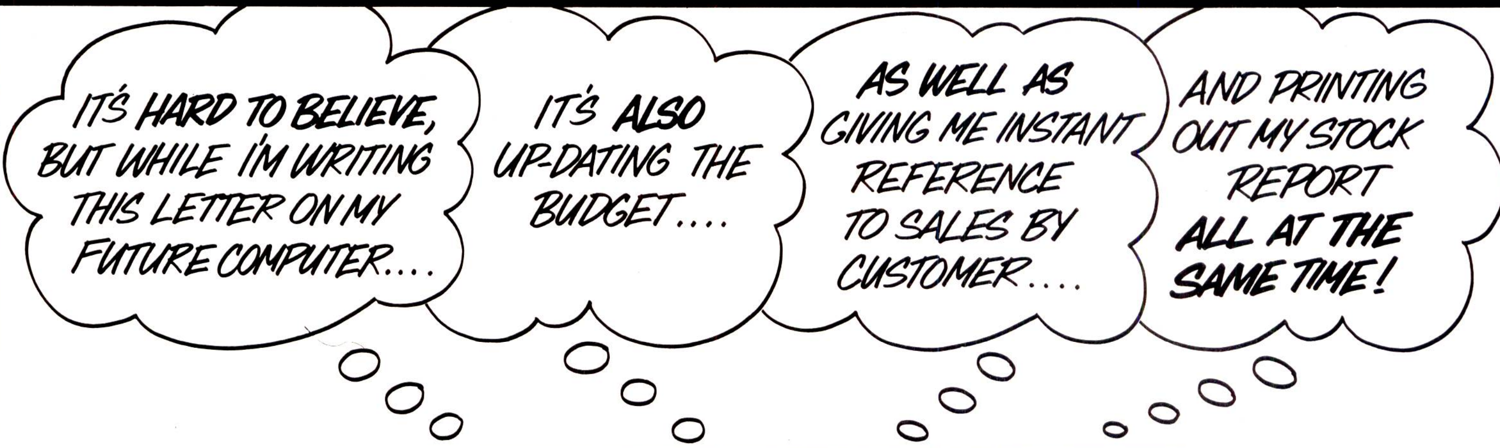
Even so, it's not a machine I would particularly recommend. The lack of a serial port rules out any form of communications, and there is very little IBM software available on cassette. I would wait a few months to see what happens on the software front before buying one.

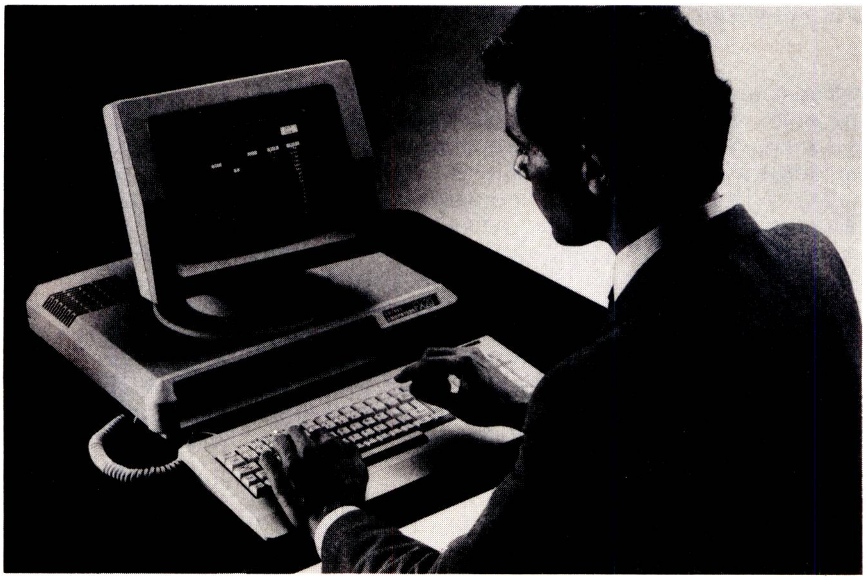
Overall, I found the Advance a great disappointment. It could have filled the gap a lot of us thought would be filled by the IBM PCjr — a cheap home micro with the capacity to upgrade to a fully-fledged PC. As things turned out, the PCjr didn't fit the bill on either front, and I don't see the Advance faring any better.

END

Technical specifications

	Advance 86A	Advance 86B
Processor	8086 running at 4.77 Mhz	As 86A
ROM	64k (diagnostics & Basic)	As 86A
RAM	128k expandable to 256k	Expandable to 768k
Video output	TV, composite video, RGB	As 86A
Interfaces	Joystick, Centronics	As 86A, plus RS232
DOS	N/A	Advance DOS 2.13 (equivalent to PC-DOS 2.11)
Interpreter	IBM Cassette Basic in ROM	As 86A, plus IBM BasicA supplied on disk





FOUR HEADS ARE BETTER THAN ONE.

The ability to work on more than one job at a time is something that we all wish we had.

That ability would be considered out of the ordinary.

Quite amazing in fact.

Like Future Computers.

The Future FX20 has the ability and power to work on four different jobs at the same time.

Just think what that means to you and your business.

No more waiting for the computer to finish a single task before you can use it. No more time wasted.

With Future you can increase your business efficiency – choose your tasks, and let them all run simultaneously while you plan your day.

And buying a Future Computer doesn't mean breaking the bank either.

Because when Future Computers designed and built their range, they set about putting together a machine that could not be beaten on overall price and performance.

And to ensure that the finished product matched the excellence of the Future design they chose Thorn EMI to manufacture them, here in Britain, backed by their own National on-site Computeraid Services.

For more information send the coupon off now – it could be the best business decision you've made today... and in the future.

To Encotel Systems Limited, 7 Imperial Way, Croydon Airport Industrial Estate, Croydon, Surrey CR0 4RR

☐ Please send me information on Future Computers, and free explanatory brochure on concurrency and networking.

☐ I would like to see a demonstration.

Name ____________ Position ____________

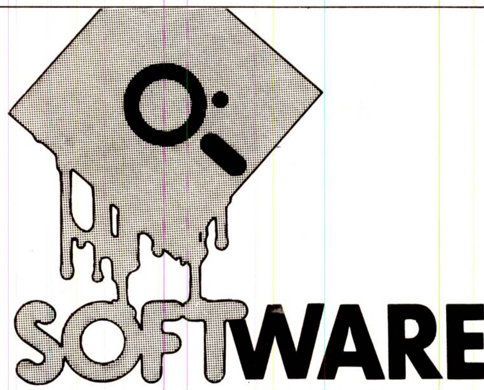
Nature of Business ____________ Company ____________

Address ____________

CP1 Telephone ____________

FUTURE COMPUTERS

The power to work on four jobs simultaneously.



Exploring WordStar

John Lee and Timothy Lee describe some simple but useful ideas which can be implemented on the WordStar word processing package.

Although WordStar is a very powerful and widely used word processing program for microcomputers running under CP/M and 16-bit machines, there are a number of simple things that ordinary users would like to do which are not explained or documented.

WordStar has a function to allow text to be underlined. This is carried out by putting ^PS before the first letter to be underlined, and ^PS after the last letter to be underlined. Many users find it annoying that this underlines the words satisfactorily, but does not underline the spaces between the words (this certainly spoils the look of headings). The easy way to underline both words and spaces is to use the WordStar underlining feature as usual, but to type the underline character in between words rather than a space:

^PSThe_easy_way_to_underline_both _words_and_spaces ^PS

It should be noted that WordStar treats the underline _ character as a letter, and hence the underlined text is considered as one large word. This may be noticeable if WordStar needs to add a lot of spaces to pad the line, as there are few words between which WordStar can insert space.

WordStar provides a wide variety of cursor movements. The usual diamond of keys ^E, ^S, ^D and ^X move up a line, one letter left, one letter right and down a line, while ^A and ^F move one word to the left or right. The command ^QR moves to the beginning of the document and ^QC moves to the end of the document, but it would be useful to be able to move to the end of a sentence. Since a sentence should always end with a full stop, the WordStar Find instruction can be used to locate the next full stop:

^QF. RETURN RETURN

If you use the above command, the cursor will be moved to the next full stop in the text. This full stop may be the end of a sentence, the decimal point in a number, or the dot in a WordStar dot command. However, there is an alternative command to move to the end of a sentence. As there is always a space after the full stop between sentences, and there is not a space after the decimal point in numbers or after the dot in dot commands, by looking for a dot followed by a space the cursor is moved more reliably to the end of a sentence. This can be achieved by typing:

^QF. SPACE RETURN RETURN

This command makes mistakes occasionally. For example, it incorrectly finds three combinations of dot and space in the following, even though they are not the end of a sentence:

Dr. John D. Lee
and
Timothy D. Lee

A small problem remains with this command. The last sentence in a paragraph will not be found, because immediately following the full stop at the end of the sentence is a RETURN which marks the end of the paragraph. Consequently we use the first of the two commands to 'move to end of a sentence'. If this command finds a dot that is not the end of the sentence the command can be typed again, or alternatively ^L can be typed to look for another dot. The second command makes fewer mistakes, but may move too far.

In a similar way, WordStar can move the cursor to the end of a paragraph — this is indicated by a full stop and a RETURN. The WordStar Find instruction can be used to locate the next full stop followed by RETURN. In ASCII, a carriage return is actually a Control-N character (stored in the file as ^N), so the required sequence is:

^QF.^N RETURN RETURN

Unfortunately this command will skip over any paragraph that has a space typed after the full stop and before the RETURN. One way of getting round this problem would seem to be to look just for the RETURN, but if this is tried, WordStar moves the cursor to the start of the next line. The best solution is to type RETURN immediately after a full stop at the end of a paragraph.

Many daisy wheel printers print the standard ASCII set of characters and are unable to print the £ sign as it's not an ASCII character. Some printers redefine the # symbol (or even the $ symbol) to print as a £ sign rather than a # (or a $).

The standard ASCII set of characters comprises 32 control codes (hexadecimal 0–1F, and 96 'printable' codes (hexadecimal 20–7F). The 96 printable codes comprise the upper and lower case letters, numbers, and other symbols such as ( ) , . ! ? : ; ' " * + − =. Also included in the 96 printable codes are ASCII 20 hex which is a space, and ASCII 7F hex which is DELete. Neither of these two codes causes anything to be printed. Daisy wheels with 96 petals thus have two petals that are not used by the ASCII set. These petals frequently contain a pound sign and a logical NOT sign. To print these characters using WordStar you should put a ^PF or a ^PG in your document. WordStar refers to ^PF as Phantom Space, and ^PG as Phantom Rubout. The actual characters printed depend on the particular wheel in your printer. If you haven't tried printing ^PF and ^PG do — you may have a pleasant surprise. We use ^PF to get £ signs. END

QX Text

This word processing package from QX Software aims to exploit the Epson QX10's idiosyncratic character sets as well as provide business-quality documentation. At £175 it's cheaper than its sole competitor but does it stand up? Jerry Sanders checks it out.

When the Epson QX10 was launched a year ago it was the only machine to have 16 character sets available in ROM. Up to last month only one word processing package existed to make full use of these fonts.

Now there's an alternative. QXText costs half as much, but offers half the facilities. The features it offers are one-key operations — control keys, dot commands and other keyboard demons don't get a look in. This makes it easy to learn and use.

QXText aims to produce documents of up to four pages which can be either A4 or A5; by turning the monitor on its side you use a screen of A4 shape — simple and effective. Pages are 52 lines × 56 characters. All 15 special fonts are easily selected, as is number 16, the print you normally get from a matrix printer.

QXText uses this normal print as a draft quality option, since it allows the printer to work bi-directionally and produce unjustified text. Printing the fancy letters is a slow business, requiring multiple passes of the print head for each line of text.

32 pages are allowed on each text disk. QXText overrides CP/M in allowing document titles of up to 25 characters, with no restrictions on character or position. Directories are presented in alphabetical order by document name together with date and time of creation/modification.

Longer documents (more than four pages) can be set up by naming further sets of four pages so that they sort consecutively in the directory. This is no more than cosmetic though, as a print command still has to be issued for each four-page set.

Help documentation is provided on disk. You select the function key required, then press the HELP key. This onscreen documentation and the redefined function keys make the package easy to learn.

Cut-out key labels slip underneath the QX10's transparent keycaps.

In use

QXText runs under Multifont CP/M. When it's booted up, you're reminded to turn the VDU on its side and the main menu offers three options: EXIT; CHANGE logged disk; and CREATE a new page.

You've probably heard of mice, but QXText asks you to choose by moving the 'gerbil' to the option required. This is a joke at the mouse's expense: it's the highlighted cursor area which encompasses the option selected.

To edit a page, you select it with the gerbil. If help is needed, a window opens underneath the text area to provide it, but in normal use there's no nasty edit menu cluttering up the screen. All the options are there on the keyboard.

QXText traps CP/M error messages before they get to the screen. If you try selecting a drive with no disk, instead of 'BDOS ERROR ON A . . .' or something equally awful, 'No disk in the left-hand drive' appears in the help window. All potentially destructive commands are protected with a fail-safe question. This, together with the onscreen documentation and the well-labelled keyboard, makes the program ideal for typists who want to move over to word processing without becoming bogged down with computer jargon in the process.

Multifonts

Creating a document is a matter of choosing the CREATE option and entering a title. In edit mode the entire keyboard with the exception of the four 'select font' keys is used.

For font selection the pause key has been redefined. Pressing it puts up the 16 fonts into the help window. To select one, the gerbil is again used. This font is now active, and remains so until another selection is made. Although the QX high-res screen can display the fonts (it does in select mode), they're not shown as such within a document as would be the case with the Apple Macintosh. 'Fonted' text is shown as reverse video, but when the cursor travels over it a window flicks open to show the font active at that point.

It's impossible to write a page and then find there's no room for it on disk. If you try, a message immediately comes up telling you not to.

Edit mode

In edit mode, response to keyboard input is somewhat slower than fast typing speed. Adequate keyboard buffering ensures that no text is lost. Similarly, paragraph reformatting (by pressing function key 1) in action is like watching a fast motion action replay of what has just been typed in.

The function keys are especially helpful, since everything is available without use of the control key. I missed a delete word key: it's either character or line. The trick is to position the cursor just before the words to be deleted and use the return key to put them onto a new line. They can then be zapped with the delete line key.

Margin in and out keys allow you to change the width of paragraphs. It's preferable to select the new width before typing, since on using paragraph reformat after typing (and after having reduced the paragraph width), any text on the first line of the paragraph to the left of the new left-hand margin is ignored.

Page-wrap is automatic, as is word-wrap. The home key doesn't take you to the top of page (there isn't a key for that function), but instead marks an individual line for centring. Centring is performed at print time but not onscreen. A small arrow onscreen indicates that a line has been selected for centring.

QXText documents printed with any but the draft quality fonts are proportionally spaced: that is, small letters

such as 'i' occupy less space than larger ones, for example, 'm'. Right justification is also automatic for factory fonts. The documentation doesn't say which printers may be used. In fact, the CP/M configure program offers 11 different Epson printers, so it's a matter of choosing which to use. QXText will also run the new Epson GX colour printer, and colour selection is achieved in much the same way as font selection.

You can only print a page from within edit mode, that is, when the page is displayed on the screen. On pressing the print function key a menu offers a choice of main font (select 0 for draft quality without proportional spacing or right justification), start and stop page number (of a document — but page numbers aren't printed), pause between pages (Y/N), number of copies, and set left-hand margin. Left margin size can be selected by using the left/right cursor arrows to alter a bar graph display (like a speedometer on a Rover 2000 car). The distance in millimetres from the left-hand margin is shown, and selected when return is pressed.

If any other font is selected it becomes the main font, active on all text not edited during input using the font functions. Thus it's possible to output the same document in a variety of styles, rather than being restricted to the one selected in edit mode. The 16 fonts on offer make QXText more powerful (at the moment) than Microsoft's Word (see Checkout in July issue), although in fairness it's the QX10 rather than QXText that's responsible. Unlike Word, however, QXText does not allow users the facility to alter the font size.

There's a bit of a pause, accompanied by an accelerating flashing gerbil, before printing starts. As the different fonts take up different amounts of space, QXText first runs through all of them to establish appropriate line lengths for the whole text before printing part of it. Draft quality then

Font styles and names

0	Standard
1	BODONI
2	OLD ENGLISH
3	FLASH BOLD
4	COMMERCIAL SCRIPT
5	HELVETICA LIGHT
6	HELVETICA LIGHT ITALIC
7	HELVETICA MEDIUM ITALIC
8	BROADWAY
9	AMERICAN TYPEWRITER MEDIUM
10	LIGHT ITALIC
11	HELVETICA MEDIUM
12	BODONI ITALIC
13	SANS SERIF SHADED
14	MICROGRAMA EXTENDED
15	OLD GERMAN

prints at normal bi-directional speed, but most other fonts require three passes of the print head.

Communications

Included on the QXText disk is a communications module, QXComms. Pressing the send/receive function key from the main menu loads QXComms (it takes about 25 seconds), and then displays directories of both disks on the screen.

Options in this mode are COPY (QXText files between drives), SEND and RECEIVE. These last two enable RS232 communications with other computers. CP/M files (for example, WordStar documents) can be read into QXTEXT in this mode and enhanced with Multifont characters: another useful area might be post-processing portable computer documents prepared in the field.

To change the QX10 protocols to match the incoming transmission, once again CP/M is used (CONFIG).

Merges and mailshots

For the extra sum of £20 (excl VAT), QXText comes complete with QXMerge. This is a modest but effective address database, label printer and mailshot package. Each address list can have up to 100 records, and each record has up to 12 fields, each of 30 characters. Field names are fixed as for an address file, so using a list as a mini-database for other purposes could get confusing.

Documentation

Separate manuals are provided for QXText and QXComms. Neither is very long as the programs are largely self-explanatory. Even so, an index would have been helpful in addition to the contents pages.

The QXMerge manual was not available at the time of going to press.

Conclusion

There are major limitations to this package (Fig 1). Response from the keyboard is slower than fast typing speeds, but ample buffering prevents text loss. This affects word-wrap, of course, which at times looks like an action replay on the screen. Paragraph reformatting isn't automatic after insertions and deletions, but is achieved using the para reformat function key.

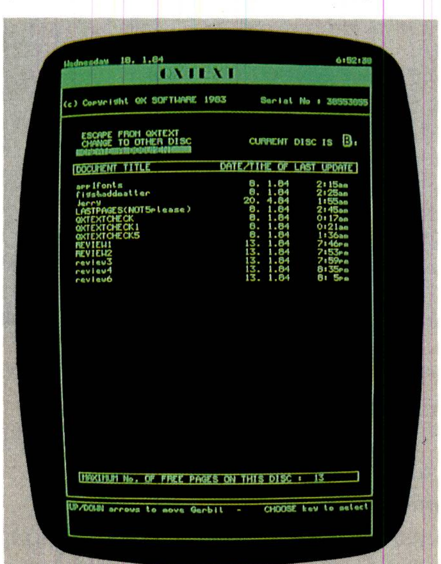
No block move/del/copy
No search/replace
No double space auto
No headers/footers
No document reformat
No page reformat
No auto page number
No page delete

Fig 1 Major limitations of QXText

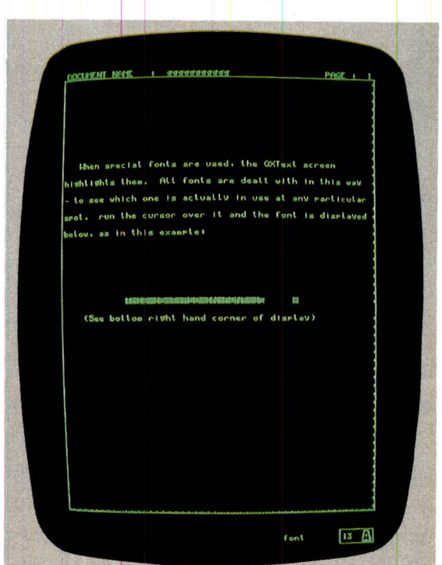
QXText achieves its objectives, but at £175 it's not cheap for an 8-bit word processor. The lack of document reformat functions puts the onus on the user to get it right first time on documents longer than a page. That's not what word processors are supposed to do! If you pay the extra £20 for QXMerge, however, the overall cost of the package becomes more reasonable.

Supplier: QX Software, tel: (0202) 762236

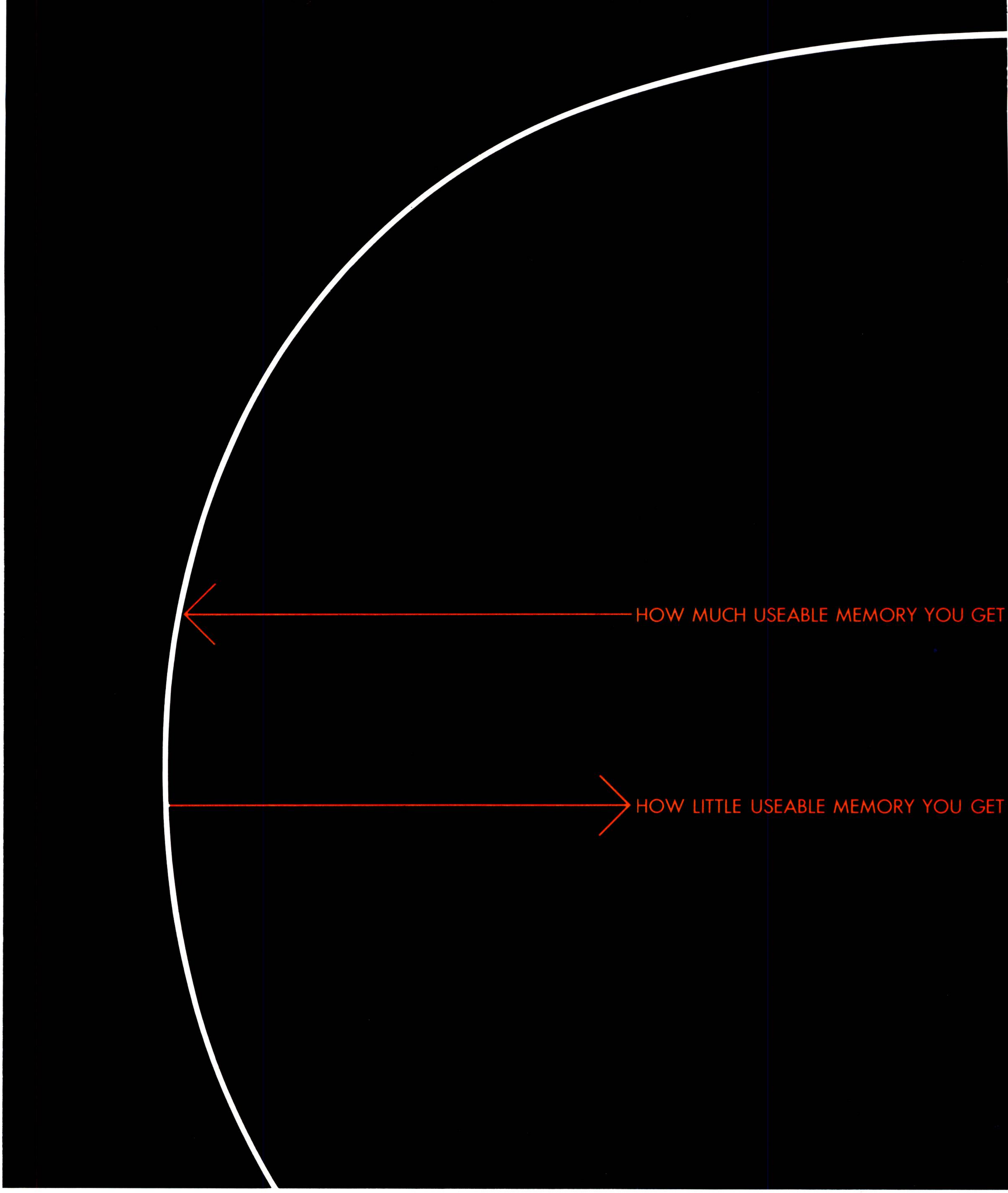
END



A4 page: sorted directory



Double-spacing? DIY!

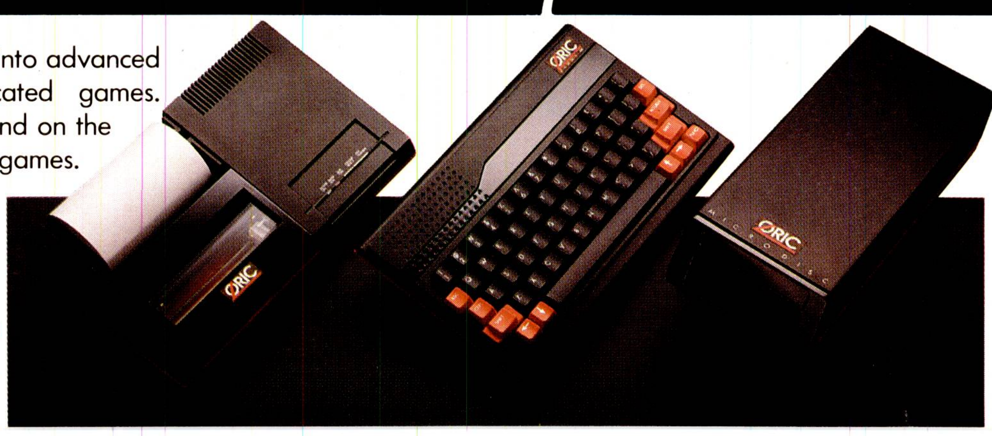

HOW MUCH USEABLE MEMORY YOU GET
HOW LITTLE USEABLE MEMORY YOU GET

you'll have plenty of memory to expand into advanced programming and extremely sophisticated games.

What's more, at full volume, the sound on the Oric Atmos competes with most arcade games.

So you can PING, ZAP, SHOOT and EXPLODE until you frighten the aliens to death. All for just £170, including all the leads and adaptors.

ORIC



RUMBELOWS, SPECTRUM AND ZAPPO COMPUTER CENTRES.

~CHECKOUT~

Tandberg TCCR 530

The Tandberg TCCR 530 is the first of what could become a new generation of computer-controlled cassette tape recorders. Terry Miles and Wayne Moulder took the machine to Mozambique for a tropical field trial, and here they report on their findings.

The Tandberg TCCR 530 is aimed principally at Tandberg's traditional clients in education and training, although this machine has many potential applications in commerce and industry.

Apart from being a formidable tape recorder in its own right, the TCCR has a set of 24 user available commands that allow it to be remotely controlled. This means that the usual tape functions (play, record, wind and rewind) can be controlled by any micro with a V24 or RS423 interface. For specialist applications, a current loop interface is provided which can be used for long distance remote control.

The TCCR 530 comes in response to the neglect of the audio component in most educational and training computer applications, where the tape recorder has become largely mute in relation to the dominant computer screen. Its use is restricted to the occasional transfer of programs and data, and its remote control potential to motor on/off.

By 'computerising' the handling of cassette tape and by providing comprehensive remote control of the recorder for the computer, Tandberg has provided cassette-based systems with an ambitious new lease of life.

Overview

The TCCR 530 sports the Tandberg house colours of orange and grey. The orange is the business end, which faces away from the operator and contains the speaker, input/output sockets and the serial interface socket. The face of the machine tilts upwards to the user at a 15° angle for optimum visibility of the tape counter display and the function controls. These are laid out in two rows, well recessed into the body of the case. Below the separate input and output levels and treble and bass tone controls, there is the on/off rocker switch and a row of nine function buttons (REWIND, STOP, WIND, RECORD, RECAP, PLAY, PAUSE, TAPE COUNTER RESET and EJECT). The sound level VU meter and the four-digit, seven-segment tape counter display are housed behind a darkened plastic panel. To their right is the cassette bay and below that, the ¼in sockets for microphone and headphone.

There are LED indicators above REWIND, WIND, RECORD, PLAY and PAUSE. Further refinements are audio warning signals, bleeps for endstops in WIND, REWIND, PLAY and RECORD, and continuous tones for warnings of absent or record-protected cassettes.

The 530 has a half track tape configuration, and Tandberg also supplies a quarter track 'language laboratory' version called the TAL812. It uses a unique four-motor, dual-capstan, closed loop tape drive in which the tape is kept under constant tension to minimise sideways movement. Infra red optic interrupters on both drive spindles monitor all tape movement, and combine with the control microprocessor and digital tape counter to give an accuracy of plus or minus 0·5 seconds in a point to point movement using any tape mode.

The micro processor in the 530 is the Intel 8749. This chip has a program storage area, some read/write memory and input/output lines on board. The program controlling the 530 is in ROM and cannot be altered unless you have some very expensive program development equipment. However, some programming is possible in that the serial interface characteristics can be stored in non-volatile memory, like

The TCCR 530: 'a formidable tape recorder in its own right'

storing the station/channel data on a video recorder. Two other chips — an I/O expander and a USART — make up the micro processor section.

In use

Before using the 530, you'll have to program the communication characteristics and transmission speed parameters. The programmable speeds range from 150 up to 9600 baud. These characteristics cover the number of stop bits, parity and data word length. To enter these parameters, you have to press the RECORD key while turning the power switch on. The parameter is then displayed on the tape counter display. To change the value of a parameter, press the RECORD and STOP keys at the same time, and this new value is written to the non-volatile memory. The WIND and REWIND keys are used to move on to the next parameter.

After making sure that the interface parameters are compatible with your micro, a cable following the V24/RS423 standard is needed. The 530 does not use the normal modem control handshake lines RTS and CTS, but relies on a form of delayed full-duplex echo of each received command.

The following example shows how to handle this on the NewBrain micro:

```
100 PRINT #9, "RF";LINPUT #9, R$
110 IF R$ = "NC" THEN 9000:REM
  ERROR
120 IF R$<>"RF" THEN 100
```

The test at line 110 is to check that the cassette compartment has been loaded. Here, NC means no cassette.

The TCCR 530 systems for tape-handling achieve maximum efficiency when the audio content of the tape is laid down in blocks with gaps of between at least three seconds. This enables it to carry out periodic checks on the actual position of the tape in terms of the signal read at the tape head, compared to the nominal position of the tape as recorded by the tape counter. Divergence between the two is then eliminated by a synchronising control. If tapes with a continuous audio content are to be used, greater care should be taken, as the tape counter will now be the only source of reference. To compensate for any positional error, strategic use can be made of the automatic tape counter reset to zero (00:00), which occurs after full rewind as well as synchronising at the known end-point of the audio soundtrack.

The TCCR uses a closed set of 24 commands which are sent from the micro as two-letter abbreviations of the command words. Some are followed by a specific tape position. The abbreviations must be sent in upper-case ASCII characters (PL for PLAY, and so on), and every complete message terminated with a carriage return code (CR). It's possible to control up to 127 TCCRs individually from one micro by specifying an address followed by the command itself.

There are three kinds of echo sent back to the micro from the recorder. Two are illustrated in the previous programming example: line 110 shows an irregularity response (NC No Cassette), line 120 contains a normal, exact echo response (RF Rewind Fast). The third kind is question marks in response to syntactically incorrect commands, one question mark per character.

Commands and responses divide into those that duplicate the manual operation of the machine, and those which can only be generated from the computer. The first stop group includes: stop (ST); play (PL); record (RE); wind fast (WF); rewind fast (RF); recap (RC); cue (CU); review (RV); clear counter (CC); eject (EJ).

Among the functions performed by the second group are reading the status of the TCCR, locking the keyboard and stopping the capstan motor, simplifying the handshake between the controlling micro and the recorder, and implementing a random access facility. There is also a command that will compensate for tape transport slippage errors.

The second group includes: read mode (RM); read tape counter (RT); program sensor (PS); disable sound (DS); enable sound (ES); disable keyboard (DK); enable keyboard (EK); motor halt (MH); motor start (MS); handshake (HS); go to (GT); to (TO); to+ (TO+), and synchronise (SY). RM, RT and PS echo back the command plus information: for example, RM should echo back RM(PL) if the recorder is in play mode. RT could echo back RT(0020), meaning twenty seconds on the tape counter. PS returns the status of the signal at the tape head both at the time the command is received and also since the last such command was sent. SY detects the start of an audio block and sets the counter to the value specified in the command. It can deal with positional errors accumulated through repeated wind and rewind, as well as the positional variations occurring in multiple tape copies of up to plus or minus eight seconds.

'Its (TCCR 530) ability to combine both audio and data recordings under micro processor control on a single tape drive opens new possibilities for both CAL and applications packages . . .'

Field trial

The field test was a rigorous one. Using language learning software written by the authors (University Audiovisual), two 530s (controlled in this case by NewBrain micros) were sent out to Maputo, Mozambique for eight weeks. In an intensive course of English for Electrical Engineers run by the London School of English, Holland Park Gardens, London the TCCR 530s performed accurately, flexibly and reliably throughout. They also had to serve as stand-alone tape recorders and public address systems, as well as cope with the humid conditions coming in the wake of a cyclone that hit the city.

Technically and educationally, the impression was of a powerful software development tool with which to prepare for the future.

The most obvious area of use for the machine is in what Tandberg refers to as AECAL (Audio Enhanced Computer Assisted Learning). The company has commissioned two authoring packages that run with the BBC Model B. One is an authorising program for general subject or language learning (incorporating graphic drawing) designed by Dr K Miller of Wolverhampton Polytechnic. The other is a 'test package for linguists' prepared by Professor Rex Last of Dundee University, also for the BBC Model B.

Another obvious application for the 530 is in public address systems where there is a need for various standard announcements, often in different languages. With the cassette tape containing computer generated data, the user-available commands can transform the recorder into an effective random access data device.

In audio-visual tape/slide presentations, the 530 (or two in combination) can be used to provide continuous and merged soundtracks. Yet more uses can be found, based on the fact that each recorder of a group (any number up to 127) can be addressed separately from one controlling micro.

Conclusion

The kind of control offered by the TCCR 530 is available only on a small number of micros (the Epson HX20, for example): this machine gives that capability to almost any micro. Its ability to combine both audio and data recordings under micro processor control on a single tape drive opens new possibilities for both CAL and applications packages, and may be the first step on the road to 'voice-on-disk' storage — a capability long overdue.

The TCCR 530 costs £484, and substantial educational discounts are available. END

University Audiovisual is a software development unit currently developing language learning systems based on the TCCR 530, plus the NewBrain and BBC computers.

All enquiries concerning the TCCR 530 should be addressed to Tandberg Ltd, Revie Road, Elland Road, Leeds LS11 8JG, tel: Leeds (0532) 774844.

Input/output control

If you've ever tried to do graphics in machine code on your Atari, access data files on disk or cassette, or dump a screen to the printer, then you'll appreciate just how difficult it is. By changing a few parameters, it's possible to send an unspecified amount of data to a device. Anthony Roberts shows you how.

Input Output Control Blocks ('IOCBs') and Central Input Outputs ('CIOs') allow the user to control input from and output to various devices. The devices that are controlled using CIOs are principally cassette recorders, disk drives, printers and the screen.

```
00010    LDX #$10     ;  IOCB #1
00020    LDA #$0C     ;  COMMAND FOR CLOSE
00030    STA $342,X   ;  COMMAND LOCATION
00040    JSR $E456    ;  CALL OS ROUTINE
```

Fig 1 Routine to close IOCB

```
00050    LDA #$03     ;  COMMAND FOR OPEN
00060    LDX #$10     ;  IOCB #1
00070    STA $342,X
00080    LDA #LAB     ;  LOW BYTE OF DEVICE NAME
00090    STA $344,X   ;  BUFFER ADDRESS (LOW)
00100    LDA/LAB      ;  HIGH BYTE OF DEVICE NAME
00110    STA $345,X   ;  BUFFER ADDRESS (HIGH)
00120    LDA #$08     ;  OPEN FOR OUTPUT
00130    STA $34A,X
00140    LDA #$00     ;  JUST TO BE SAFE BUT NOT NEEDED
00150    STA $34B,X
00160    JSR $E456
```

Fig 2 Program to open an IOCB

Before you can open an IOCB, it must first be closed. This is to prevent errors occurring when you attempt to open an already open IOCB.

To close an IOCB, choose which one you are going to work with. There are five possible choices which correspond to the numbers 1,2,3,4 and 5 in Basic. In machine code, you choose the number by loading it into the 'X' register. The number you load is '#$10' for IOCB 1, '#$20' for IOCB 2, and so on. When you have decided, the routine in Fig 1 will close that IOCB.

Line 10 tells the computer which IOCB to close. Line 20 loads the accumulator with the number #$0C (this is the number which tells the routine you want to close the IOCB). Line 30 stores the number #$0C in location $342 offset by 'X'. As 'X' contains the value of #$10, the number will be stored in $352. The 'X' register is used because the computer uses the value in the 'X' register to decide which one to close. Line 40 calls the operating system routine that actually performs the close operation.

Now that the IOCB is closed, it should be opened for a device. You need to declare the device name, which is best done by storing it in an ASCII string. Let's use the conventions employed by the Syn-Assembler, but there are conversions for the Atari Assembler/Editor. Fig 2 will open an IOCB: see Fig 3 for the full list of device names.

The program opens IOCB 1 for the screen editor (E:). Lines 50, 60 & 70 tell the computer to open up IOCB 1. Line 80 loads the accumulator with the low byte value address of the label 'LAB': for example, if the address of the label 'LAB' was $1234, the low byte value of the address would be #$34. Line 90 stores this value in a location where the computer can find it for later use. Lines 100 and 110 do the same thing, except they load and store the high byte value of the address: for example, #$12.

'E:'.... Screen editor (see basic manual)
'S:'.... Screen graphics for graphics modes
'P:'.... Printer (output only)
'K:'.... Keyboard (input only)
'C:'.... Cassette recorder
'D:*.*'.... Disk directory
'D:filename.ext'.... Disk files

Fig 3 Device names specified when opening a device

Location	What it is used for	Possible values	Result of using value
$E456	Calls the routine to act on IOCB.	None	Execution of IOCB.
$342	Sets the way the IOCB will be used	3	Open the IOCB.
		12	Close the IOCB.
		7	Get binary record.
		11	Put binary record.
		4	Input string.
		8	Output string.
$344	Low byte value of buffer address	0-255	Tells the computer the low byte address of where to get or put data.
$345	High byte value of buffer address	0-255	Same as above only high byte.
$348	Low byte value of buffer length	0-255	Sets the amount of data to be moved. (low byte).
$349	High byte value of buffer length	0-255	Same as above only high byte.
$34A	Sets the direction of data transfer	4	Read and write data.
		8	Open for directory.
		12	Read and Write data.
		6	Open for directory.
$34B	Used mainly for graphics.	0-255	See graphics table.

Fig 4 I/O critical memory locations.

```
00170          LDA #$08      ;  GOING TO SEND STRING
00180          LDX #$10      ;  IOCB #1
00190          STA $342,X
00200          LDA #MES      ;  LOW BYTE OF MESSAGE ADDRESS
00210          STA $344,X
00220          LDA /MES      ;  HIGH BYTE OF MESSAGE ADDRESS
00230          STA $345,X
00240          LDA #$FF      ;  MUST BE MORE THAN MESSAGE
                                LENGTH
00250          STA $348,X    ;  BUFFER LENGTH HELD HERE (LOW)
00260          LDA #$00      ;  JUST TO BE SAFE
00270          STA $349,X    ;  BUFFER LENGTH HELD HERE (HIGH)
00280          JSR $E456
00290          LDA #$0C      ;  CLOSE IOCB #1
00300          LDX #$10
00310          STA $342,X
00320          JSR $E456
00330          BRK           ;  END OF PROGRAM
00340 LAB      .AS "E:"      ;  DEVICE NAME
00350 MES      .AS "ATARI COMPUTERS ARE GREAT"
00360          .HS 9B        ;  END OF LINE CHARACTER
```

Fig 5 Routine for sending data to the device

These four lines are necessary because when the computer comes to perform the open, it can look in locations $348 and $349 to find the address where the name of the device is located (E: is the name of the device). Lines 120 and 130 put a #$08 into $34A,X. The contents of location $34A,X tell the computer in which direction the data will be travelling (that is, to or from the device). In this case, the 8 means we will be sending data. Lines 140 and 150 are just to be tidy; the 0 in the location has no effect on this particular IOCB. Line 160 calls the routine to do the open. Fig 4 shows the critical memory locations.

In use

Now that the IOCB is open, you'll want to do something with it. In this case, because we put a #$08 into $34A,X, we want to send data. The routine in Fig 5 is used.

The routine in Fig 5 will print the message on the screen. Lines 170 to 190 put a #$08 into the command location ($342); the #$08 tells the computer to expect an undetermined amount of data. This is comparable to printing a string in Basic, because you don't need to know how long the string is to print it. The computer will stop printing data when it reaches a #$9B. Lines 200 to 230 instruct the computer where to find the data for what it has to print; lines 240 to 270 tell the computer how much data to send. As we have used a #$08 in $342,X, the number in these two locations has to be more than we want to send. If you were to send a known amount of data, these two locations would contain this number. $344,X is the low byte and $345 is the high byte. Line 280 executes the operation.

If you are not familiar with the low byte, high byte notation, it simply means the storing of numbers greater than 255 in two consecutive locations. As the maximum value in one location is 255, we have to store numbers greater than this in a special way. The high byte location contains the number of 256's in the number, and the low byte location contains the number of 1's in the number. To store the number 1027, place a 4 in the high byte ($4\times256=1024$) and a 3 in the low byte ($3\times1=3$): the result is $1024+3=1027$. The same principle is used when storing an address.

When the program has been written, close the IOCB by using the first part again. More than one IOCB can be open at a time, so you can read data from a disk using one IOCB and print it to the screen using another. Here is an example of some conversions:

Syn-Assembler   Atari Assembler/Editor

#LAB.. LAB&255
/LAB.. LAB/256
.AS "ATARI etc" ...... .BYTE "ATARI etc"
.HS 9B.............................. .BYTE #$9B

If you are using the Atari editor, you'll need a '*=$4000' at the start of the program.

As an example of IOCB use, the program in Fig 6 will open the screen for graphics mode 2 and print a message.

When the graphics screen is opened, the mode number goes into location $34B,X. Location $34A,X contains details of the type of screen you want — that is, split screen configuration. Fig 7 shows how to obtain the different types of screen.

128	64	32	16	8	4	2	1
		C	S	W	R		

Fig 7 Obtaining different screen types

If bit 'C' is set (equal to 1), the current display will not be cleared when the screen is opened.

If bit 'S' is set, the screen will be set up for a split screen arrangement. This is the same as if you were to open a screen in Basic without putting the '+16' on the end, (GRAPHICS 2, for example).

If bit 'W' is set, it instructs the screen to expect data. This is set for 'plots' and 'drawtos'.

If bit 'R' is set, the screen will be set up for data retrieval from the screen; this is used in 'locate' statements. END

```
00010  ;  Graphics mode 2 program
00020  ;
00030          LDX #$10      ;  CLOSE IOCB #1
00040          LDA #$0C
00050          STA $342,X
00060          JSR $E456
00070          LDA #$03      ;  OPEN IOCB #1
00080          LDX #$10
00090          STA $342,X
00100          LDA #SNAME    ;  DEVICE NAME (LOW)
00110          STA $344,X
00120          LDA /SNAME    ;  DEVICE NAME (HIGH)
00130          STA $345,X
00140          LDA #$18      ;  SPLIT SCREEN + OUTPUT
00150          STA $34A,X
00160          LDA #$02      ;  GRAPHICS MODE
00170          STA $34B,X
00180          JSR $E456
00190          LDA #11       ;  PUT BINARY RECORD
00200          LDX #$10
00210          STA $342,X
00220          LDA #$06      ;  AMOUNT OF DATA TO SEND (LOW)
00230          STA $348,X
00240          LDA #$00      ;  AMOUNT OF DATA TO SEND (HIGH)
00250          STA $349,X
00260          LDA #WORD     ;  LOW BYTE ADDRESS OF MESSAGE
00270          STA $344,X
00280          LDA /WORD     ;  HIGH BYTE ADDRESS OF MESSAGE
00290          STA $345,X
00300          JSR $E456
00310          BRK           ;  END OF PROGRAM
00320 SNAME    .AS "S:"      ;  DEVICE NAME
00330 WORD     .AS "MODE 2"
```

Fig 6 Graphics mode 2 program

TEACH YOURSELF LISP

Most modern artificial intelligence languages were developed from, and often written in, a dialect of Lisp. In the first of his Teach Yourself Lisp series, Dick Pountain examines the concept of list processing.

The forty year history of digital computing is punctuated by the emergence of powerful ideas, but the most powerful of all may turn out to be that of List Processing (or Lisp!).

In one form or another List Processing has become the dominant programming technique in Artificial Intelligence (AI) research, but it's completely failed to penetrate into the world of commercial computing and is unknown to most microcomputer enthusiasts. An enormous gulf, almost too wide for mutual comprehension, has opened up between those AI programmers who cut their teeth on Lisp (or Prolog or POP-2), and the rest of us who started with Basic and moved on, if at all, to Assembler, Pascal, Forth or C.

In this series we shall try to explain the principles behind Lisp, the mother and father of list processing languages (and many would say still the most elegant).

Lisp is, rather surprisingly, one of the oldest computer languages, having been conceived between 1960 and 1965 by John McCarthy at the Massachusetts Institute of Technology (MIT). Its relative lack of popularity can be put down to the fact that it's not very suitable for routine commercial data processing, being quite inefficient in both speed and memory requirement. All the more modern AI languages such as Logo, Prolog and POP-2 are heavily influenced by Lisp (and were often originally implemented in it).

In recent months implementations of Lisp, Logo and Prolog have become available for machines like the Sinclair Spectrum, Commodore 64, BBC B and the NewBrain (and CP/M versions have been around for a year or two); now is as good a time as any to find out what all the fuss was about.

The available books and manuals on Lisp often underestimate how foreign most of its concepts will be to the Basic trained programmer, and are consequently less useful than they might be. We hope to fill the gap for you in the crucial early learning days.

Concepts

It's tempting with any language tutorial to dive straight in with program examples (even if it's only 'Hello World!'). In this first part though, let's look at the concept of list processing itself, because, until that is understood, the very purpose of Lisp programming will remain a mystery.

In everyday life lists are a common enough device for keeping track of a number of objects or actions; everyone makes shopping lists or lists of things to do. The following list:

Eggs
Milk
Coffee
Cornflakes

requires little explanation; it's a list of food items to buy at the shop (and in this case the order is not important). A list such as this is a natural data structure for representing objects in the real world. The types of operation that we perform on lists like this are: adding a new item (we've just run out of Butter); crossing off an item to show that we've bought it, and searching the list to see if an item is there.

We don't expect there to be any serious limitation to the way these operations are performed (apart from running off the end of the paper). Unfortunately computers, and most conventional computer languages, can't handle such lists in any graceful way.

The computer itself has no notion of any objects apart from binary numbers (whether 8, 16 or however many bits). 'High level' languages like Basic and Pascal can allow us to pretend that the computer understands other objects.

By using the ASCII code we can 'teach' it the letters of the alphabet: in the right circumstances 65 means 'A'. These letters can be put together into strings like "CORNFLAKE". Strings or numbers can be built up into larger units by using the array data structure, so that:

```
SHOPLIST$ (4) = "Cornflakes"
```

Are these adequate tools for dealing with lists? Not really. If we represent the shopping list as a string:

"Eggs Milk Coffee Cornflakes"

the computer regards it as an unstructured sequence of characters, since <space> is just another character (ASCII code 32).

If we wanted to search such a string for a given word, we'd have to write a program segment to look for spaces just to extract separate words. Basic's string handling functions, though powerful in their own sphere, also produce notoriously unreadable code such as:

```
IF MID$(SHOPLIST$, SPACES
  (COUNT)+1, SPACES(COUNT+1)))
  = ITEM$
```

merely to extract one item.

An array is a bit better, in that the words are at least stored as separate objects, but it becomes clumsy when you want to add and remove items at will, to an unspecified maximum length, while maintaining an order. Both are unsatisfactory if we want to mix numeric and string data (the numbers will have to be represented as strings and recovered using VAL()).

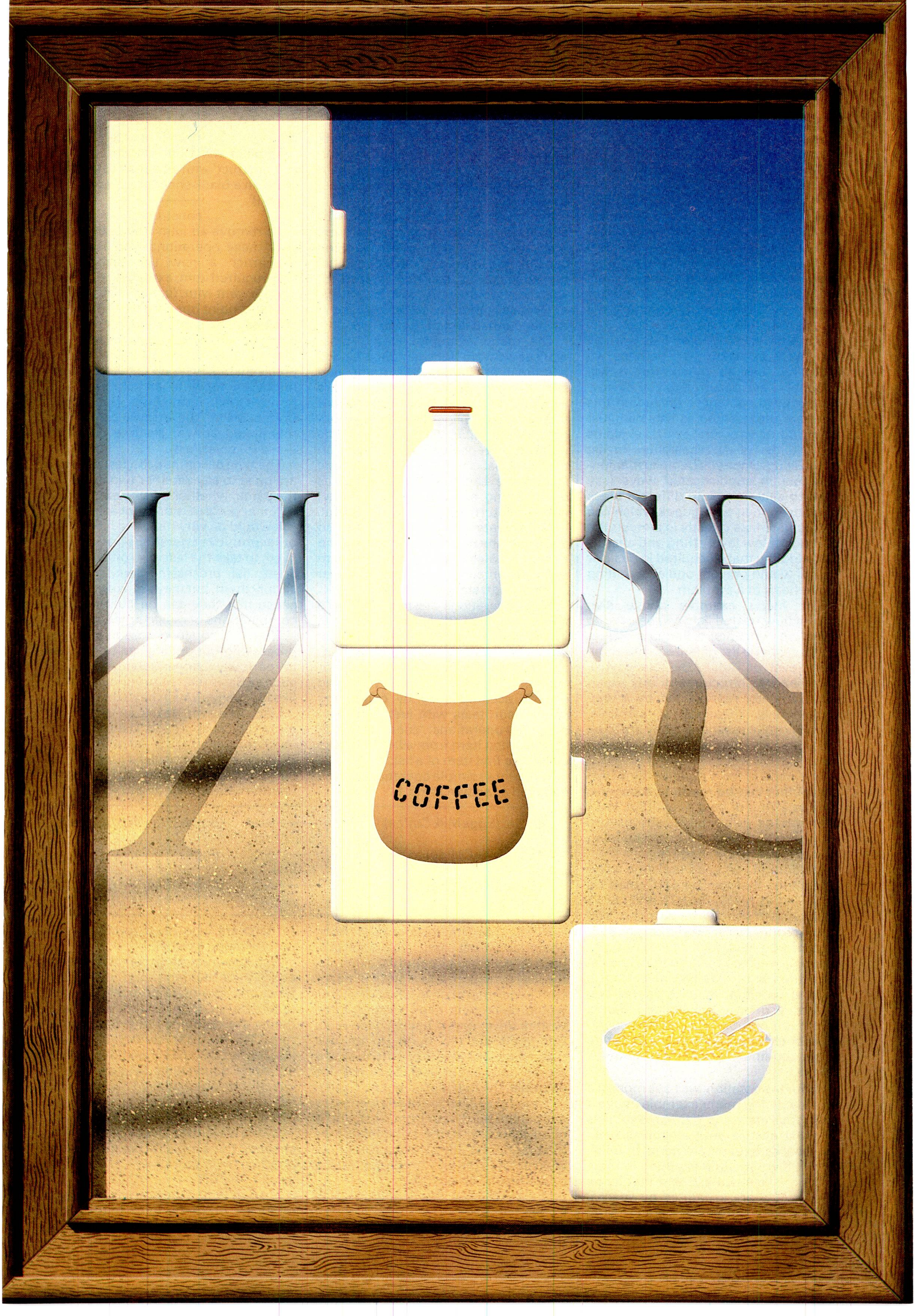
Basic also has the READ . . . DATA construct which would allow us to write:

```
100  READ EGG$,EGG,MILK$,MILK,
     COFFEE$,COFFEE
200  DATA "Eggs", 12, "Milk", 4,
     "Coffee", 1
```

but this allows us no flexibility at all to modify the list unless we can stomach writing self-modifying code using PEEKs and POKEs!

In any case, we have only just scratched the surface of what lists are all about in our shopping list example. What about a more highly structured list such as:

Monday lunch (trout tripe truffles)


LISP
COFFEE

Monday dinner (oysters pheasant spinach)
Tuesday lunch (spam ham flan (puff-pastry apricots almonds) roquefort)

In this list some of the items are themselves lists, and one of these sublists (flan) has an item which is a sub-sublist. The normal way to deal with this in Basic is to use a three-dimensional string array (dimensions DAY, DISH, INGREDIENTS) and most of its slots would be empty, resulting in a huge waste of memory.

If menus and shopping lists were all that were at stake, then perhaps we wouldn't fuss so much. But it will probably have occurred to you by now that English sentences (including this one) are represented as lists with just this kind of structure, which explains the interest of AI researchers in list processing. Once you begin to manipulate text in sophisticated ways (say parsing sentences into different types of clause), then a language which can manipulate lists directly is a must; the amount of low level string and character twiddling that is required in Basic or Pascal would prevent one ever getting to the heart of a problem.

The menu example above also shows how nested lists can be used to structure concepts; a flan is a dish at one level but a list of ingredients at the next level of detail. By this device, complex tree structures of any depth can be neatly represented by a one-dimensional sequence of symbols, which is quite essential if they are to be fed into most contemporary computers.

The need is for a notation by which computers can be made to recognise lists as a kind of data of a higher level than strings or numbers; strings and numbers (and lists!) will be the building blocks that lists are made of.

In addition, we need to define a few operations that can be performed on lists (just as MID$, RIGHT$ and LEFT$ can be performed on strings). You could produce a list (*sic*) as long as your arm of potential such operations (for example, replace the fifth item in a list with the next-to-the-last item from a second list) but, in a computer language, economy will dictate that a minimum number of primitive operations be chosen, plus a means of bolting these together to do more complex things.

As for the notation, we have most of it already. In the menu example above, I used brackets '(' and ')' to show sublists in a list and in both examples used spaces to separate items in a list.

If we say that anything in brackets is a list, and that items are separated by spaces, then we would rewrite the two examples so:

(Eggs Milk Coffee Cornflakes) and:
(Monday lunch (trout tripe truffles) Monday dinner (oysters pheasant spinach) Tuesday lunch (spam ham flan (puff-pastry apricots almonds) roquefort)

Items can be numbers or words or sublists or a mixture; square or curly brackets could just as well have been chosen, and another separator character such as a comma instead of <space> would work. The advantage of <space>, though, is that it's used in written human languages.

The menu example doesn't quite work as we want (for example, Monday and lunch are separate list items, flan and the list of its ingredients are separate items), but don't worry about that for now. Taking the simpler shopping list example, we can think of the brackets as representing the paper on which the list is written. The advantage is that we can then think of '()' as representing a blank piece of paper, which will turn out to be rather useful. This concrete analogy isn't quite so good with the nested lists in the second example, unless you can imagine them as being on separate scraps of paper stuck on with stamp hinges!

What operations are needed? We'd like to be able to add to the list, remove items from the list, search the list for an item, add lists together, compare lists and more. Mindful of the need for economy, it turns out that everything can be accomplished by combining comparison tests with just three fundamental operations: 'construct a list', 'take the first item from a list' and 'take all but the first item of a list.'

These three simple operations can be depicted as shown in Fig 1.

Butter (Eggs Milk Coffee)	———> 'construct'	(Butter Eggs Milk Coffee)
(Eggs Milk Coffee)	———> 'first'	Eggs
(Eggs Milk Coffee)	———>	(Milk Coffee)

Fig 1

Notice that 'first' produces an **item**, while 'construct' and 'rest' both produce **lists**. In the shopping list example, the list corresponds to a piece of paper with pencil marks on it, while the items would be 'in your head' waiting to be written down or just having been read. But don't get too hung up on this distinction, because in our menu example an item could itself be a list (for example, the flan ingredients).

It should be clear that if you wanted to extract the third item from a list, you'd need to repeat some combination of 'first' and 'rest' (depending upon how we'd defined the way of combining the operations). For example:
first —> rest —> rest —> (Eggs Milk Coffee Sugar)
would do the trick if the arrows mean 'do it to everything to my right' and they are evaluated from right to left.

To build a list from scratch, you need to 'construct' with an empty list: that is, write on a blank sheet of paper:
Eggs () ———> 'construct' (Eggs)

To remove an item from a list using only these operations, you'll have to 'construct' a new list, lacking the non-required item, extracting the items you *do* want with 'first' and 'rest'.

At this point our concrete analogy is strained to breaking point, for a human being would merely cross the item out. Lisp though, as we shall see, does it precisely this way. As an exercise you might try to write an expression to remove Milk from (Eggs Butter Milk Coffee) using the arrows convention mentioned above; assume construct —> a (b) gives (a b).

The type of comparison tests needed are ones to say whether two items are the same, whether a list is empty, and whether an item is or is not a list.

It would be very handy to have a few other primitive operations (for instance 'last', to take the last item off a list) and some list processing languages do supply them, but they're luxuries in the sense that they can be built up from combinations of these three basics.

There is no good reason why list processing operations can't be added to perfectly conventional languages such as Basic (there are various Pascal-like languages which have them).

Lisp, however, takes an altogether more radical approach. List notation is used throughout the language; Lisp programs are themselves lists and can be fed as data to other Lisp programs (another reason for its attraction to AI researchers who need to create self-modifying programs).

Lisp programming consists almost entirely of defining and evaluating functions, in a manner much closer to mathematics than to the way statements are combined in a Basic program. The familiar control structures IF...THEN, FOR...NEXT and GOTO have no direct equivalents in pure Lisp, in which control is achieved mainly by the list structure itself and by recursion: that is, functions which call themselves.

By the way, just so that you won't feel cheated, the simplest Lisp program to produce Hello World! is:
'(Hello World!)
if you don't mind the brackets. If you do mind the brackets, think hard before proceeding with Lisp! END

LISP DISCOUNT VOUCHER see page 102

BY NEXT YEAR, EVEN IBM MIGHT HAVE ONE.

This is the Sanyo MBC 555.

The first high performance business machine of its kind to offer the compatibility and versatility of a true 16-Bit business micro for less than £1,000 + VAT.*

A revolutionary price for a revolutionary machine because with 128K RAM expandable to 256K RAM, both the twin drive MBC 555 and the single drive MBC 550 have an 8 colour graphics capability (640 x 200 dot resolution), an 8088 CPU for high-speed processing, a Centronics parallel printer interface and free bundled software.

Add to this the support of a compatible range of peripheral equipment, a comprehensive selection of software and a price tag of less than £1,000 + VAT (MBC 550 £749 + VAT) and you'll probably understand why this package is so attractive.

But the real beauty of the MBC 555/550 series is that you don't have to wait until next year for them.

If you want to see these two innovative machines from Sanyo's proven range of Micros phone LOGITEK on 0257 426644 or STC on 0279 26777 or ICARUS on 01-485 5574 or clip the coupon and we'll show you how to stay one step ahead.

*EXCLUDING MONITOR.

Name

Company

Position in Company

Address

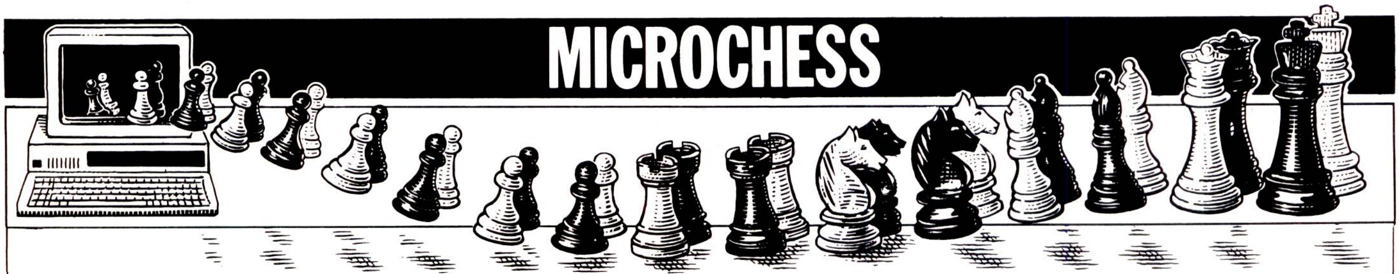
Tel. no

P.C.W.2

Return to: Marketing Dept., Sanyo Marubeni (UK) Limited, Sanyo House, 8 Greycaine Road, Watford, Herts.

SEE SANYO, THEN DECIDE

SANYO



Star constellation

Novag's Constellation is already a force to be reckoned with in computer chess, but even better things are on the way, as Tony Harrington discovers . . .

Back in October 1983 we looked at the Novag Constellation. Novag has now beefed up the standard Constellation's processor speed from 2MHz to 3.6MHz, which, for very little more money, offers a definite increase in power over the standard 2MHz version.

In playing terms, the increased processor speed has resulted in a slight gain in strength at tournament level and an appreciable gain at the blitz level. Ken Thomson (of Belle fame) reckons that one ply (one move by either side) is worth 250 ELO points. You have to take account of the branching that occurs in the search tree when a program considers a further ply. With an efficient pruning algorithm, the branching factor is about six, so six times as fast gives you 250 ELO points, 1.8 times as fast gives you 75 points — thus putting the 3.6 version 75 ELO points ahead of the standard version.

What this actually means to the player attempting to beat Constellation is difficult to define. It is also a little academic, since Novag is about to launch the Super Constellation, which has already proved itself much stronger than even the beefed-up 3.6 version.

Nevertheless, the 3.6MHz machine with its 16k program will be around for a while yet, despite the imminent launch of its bigger 52k program, 4 MHz brother. And since it will, in all probability, be considerably cheaper than the Super Constellation it should have no difficulty in finding takers.

The games section contains the results of one tournament level game played by the 3.6 version against the Mephisto III (with annotations by Grandmaster Dr John Nunn).

In a one off game anything can happen. My interest in this particular game is twofold. Firstly, the game shows that the Constellation, even in its 3.6 MHz format, has a tendency to over aggressive tactical plays which can get it into self-inflicted difficulties. Secondly, it produced, by computer chess standards, a very interesting ending which both machines played better than might have been expected.

While the Mephisto III seemed to be able to hold its own at tournament level, at speed chess (five seconds a move) there was no contest. The Constellation 3.6 scored a clean sweep here with five out of five.

So, from the buyer's point of view, if you like playing speed chess, the 3.6MHz machine looks good.

The Super Constellation looks like being even better. At the Commonwealth Championship (sponsored by Novag) and held in Hong Kong recently, the Super Constellation beat 18 out of 29 tournament players at blitz chess (and all the players in the tournament had ratings of 2200 or over). Its victims included a couple of international masters; only the Grandmasters seemed to be able to cope. The Super Constellation's rating for the tournament proper (as opposed to the speed chess event) was 190.

This still has to be confirmed, but the ELO equivalent is around 2120.

David Kittinger, the program's designer, reckons that it could be the first master level microcomputer program. Enrique Irazoquil, who carried out a substantial review of the Constellation's play for *Computer Chess Digest*, sums it up thus:

'Constellation is tactically better and positionally weaker than most human players. It plays some very nice games and some rather poor ones. At speed chess, it is the best thing on the market, with the possible exception of the Fidelity Prestige.'

Novag has entered an experimental form of the Super Constellation in several other open competitions, including the 1983 US Open.

It recorded the first win of any microcomputer over a rated master under actual tournament play conditions, beating Jerry Simon, rated 2207 in 55 moves. One Al Goncer, rated 2037, also fell victim, as did Strayer, rated 2138, and one or two others who should have known better.

This level of performance is much stronger than most casual players can expect to beat. So it opens the question, once again, as to the point of developing even stronger chess programs.

The real benefits of further development will be felt in better play at the faster response times. Casual chess players like to have virtually instant responses to their moves. Hanging about for five or ten minutes while the computer grinds out a reply at tournament level time settings is tedious; Super Constellation promises to take a large step towards solving that particular problem.

Its arrival on the market will send shivers through Novag's competitors, since if the commercial version lives up to this preview when it is released in September or October this year, there will be nothing in its class.

Games section

White: Mephisto Y. Black: Super Constellation. Budapest 1983. Sicilian Defence. Notes by David Levy.

1	e2-e4	c7-c5
2	Ng1-f3	d7-d6
3	Bf1-c4	e7-e5
4	0-0	Ng8-f6??

(A terrible move, but it requires an 11-ply search to realise that White can win a pawn in reply.)

5	Nf3-g5	d6-d5
6	e4xd5	Bc8-f5

(Now Black can see that 6 . . .Nf6xd5 allows 7 Ng5xf7! Ke8xf7 8 Qd1-f3+ Kf7-e6 9 Nb1-c3, winning back the piece with an overwhelming game.

7	Nb1-c3	Bf8-d6
8	Bc4-b5+	Nb8-d7
9	d2-d3	0-0
10	f2-f4?	

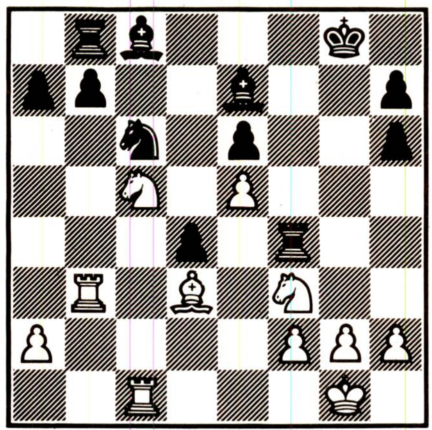
(Unnecessarily opening up a diagonal to White's king, and by allowing the trade of the d6 bishop immediately increasing the pressure on the d5 pawn. White was a safe pawn up and need not have taken any such risks.)

10	...	e5xf4
11	Bc1xf4	Bd6xf4

12 Rf1xf4 Bf5-g6
13 Ng5-e4
(No matter how White plays, the d5 pawn is looking precarious.)
13 ... Qd8-b6
14 Ne4xf6+ Nd7xf6
15 Ra1-b1 a7-a6
16 Bb5-c4 Qb6-d6
17 Qd1-f3 b7-b5
18 Bc4-b3 Ra8-d8
19 Rb1-e1 h7-h6
20 a2-a3 Nf6-h5
21 Rf4-h4 Qd6-b6
(Threatening 22 . . . c5-c4+
22 Qf3-e3 Nh5-f6
23 Nc3-e4 Rf8-e8
24 Ne4xf6+ Qb6xf6
25 Qe3xe8+ Rd8xe8
26 Re1xe8+ Kg8-h7
27 Rh4-h3 Qf6xb2

For the time being the complications have come to an end, and once White loses the a3 pawn the position will be materially level (a queen and pawn are worth roughly the same as two rooks). White's rooks are not particularly well coordinated in this position, but with correct play I would not expect White to lose. On the other hand, it is easier in a computer game to play with an active queen than with two rooks.)

28 Rh3-e3 a6-a5
29 d5-d6
(Losing the d-pawn, but the threat of . . . a5-a4 could not be met.)
29 ... Qb2-a1+
30 Kg1-f2 Qa1-f6+
31 Re3-f3 Qf6-d4+
32 Kf2-f1 c5-c4
33 d3xc4 b5xc4
34 Bb3-a4 Qd4xd6
35 h2-h3 c4-c3
36 Ba4-b3 Qd6xa3
37 Kf1-e1
(After 37 Kf1-g1 a5-a4 38 Bb3xf7 Bg6xf7 39 Rf3xf7 Qa3-c1+ 40 Kg1-h2 Qc1xc2, Black's passed pawns look very menacing.)
37 ... Qa3-c1+
38 Ke1-f2 Bg6xc2
39 Bb3xf7 Qc1-d2+
40 Kf2-g1 Bc2-a4
41 Bf7-g8+ Kh7-h8
42 Re8-c8 Ba4-d7
43 Rc8-f8??
(43 Rc8-d8 appears to save the game: for example, 43 . . . c3-c2 44 Bg8-b3+ Kh8-h7 45 Bb3xc2.
43 ... Qd2-d4+
44 Rf3-f2?
(As a matter of principle I would prefer not to walk into a pin, and would have moved the king instead.)
44 ... h6-h5
45 Bg8-b3+ Kg8-h7
46 Bb3-c2+ kh7-h6
47 Kg1-f1??
(Correct was 47 Kg1-h1. See how much better things would be for white had it played 44 Kg1-h1 instead of 44 Rf3-f2.)
47 ... Qd4-e3
48 Rf2-e2 Bd7-b5
49 Rf8-h8+ Kh6-g5
50 h3-h4+ Kg5xh4
(White resigns.)



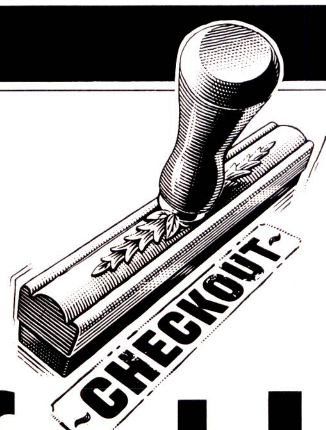
Position after 10 . . . Nf6xe4

White: Constellation. Black: Mephisto III. Notes by Grandmaster Dr John Nunn.

The Constellation is the 'fast' version, running at 3.6MHz. Mephisto is reputed to be better at strategy than tactics, but it quickly exploited an opening error by Constellation to win a pawn. A further dubious knight adventure by Constellation should have cost the game, but Mephisto erred and a fascinating ending resulted.

1 c2-c4 e7-e6
2 Ngl-f3 c7-c5
3 e2-e4 Nb8-c6
4 Nbl-c3 Ng8-f6
5 d2-d4 c5xd4
6 Nf3xd4 Bf8-b4
7 Bcl-g5??
(A move capable of sending a shudder down the spine of a hardened chess master. Material loss is unavoidable after Black's reply. 7 Nd4xNc6 was essential.)
7 ... Qd8-a5!
(With threats to c3, g5 and e4.)
8 Nd4xNc6 Bb4xNc3+
9 b2xBc3 Qa5xBg5
10 Nc6-d4 Nf6xe4
(Black has not only won a pawn but also inflicted serious weaknesses on White's queenside.)
11 Nd4-b5 Qg5-e5?!
(11 . . . 0-0 was a simpler and better way of meeting the threat 12 Nb5-c7+.)
12 Qd1-d4 Qe5xQd4
13 c3xQd4 0-0
(White's pawn structure has been improved by the exchange at d4 and although Black should still win, he now faces a much harder task.)
14 Bf1-d3 f7-f5
15 Nb5-c7
(The start of a pointless knight manoeuvre. 15 f2-f3 followed by Nb5-d6 would have occupied a useful outpost.)
15 ... Ra8-b8
16 0-0 b7-b6
17 Nc7-b5 a7-a6
18 Nb5-a7?
(Suicidal. The knight has no way to escape from a7 and should soon be rounded up.)
18 ... Bc8-b7
19 f2-f3 Rb8-a8?
(Black sees the chance for temporary material gain and takes it. However, 19 . . . Ne4-f6 would have left White helpless against the threat of 20 . . . Rb8-a8 winning a piece.)
20 f3xNe4 f5xe4
21 Rf1xRf8+ Kg8xRf8
22 Bd3-e2 Ra8xNa7
(Thanks to his 19th move Black has won a second pawn, but now White forces the recapture of one of the lost pawns.)
23 Ra1-b1 b6-b5
24 c4xb5 a6xb5
25 Be2xb5 Kf8-e7
26 a2-a4 Ke7-d6!
(Mephisto understands that the king should be used actively in the end game.)
27 Rb1-f1 Bb7-c6
28 Rf1-f7 Kd6-d5
(Black's passed pawn at e4 will become a powerful weapon when aided by his king. With a potential queen at stake, Black doesn't mind the loss of his kingside pawns.)
29 Rf7xg7 Bc6xBb5
30 a4xb5 Kd5xd4?
(Black shouldn't take this pawn because it can be used as a shield to defend his king against checks from White's rook; for example, he could have won easily by 30 . . . e4-e3! 3 Kg1-f1 Kd5-e4 32 b5-b6 Ra7-a1+ 33 Kf1-e2 Ra1-a2+ 34 Ke2-f1 Ke4-d3 — notice that the pawn on d4 prevents Rg7xd7 with check — and the e-pawn will promote.)
31 b5-b6 Ra7-b7?
(Throwing away the win. One of the basic rules of rook and pawn endings is that the rook should be deployed to the rear of enemy passed pawns. 31 . . . Ra7-a1+ 32 Kg1-f2 Ra1-a2+ 33 Kf2-f1 d7-d5 34 b6-b7 Ra2-b2 would still win.)
32 Rg7xh7 e4-e3
33 Rh7-h4+?
(A misguided move. After 33 Kg1-f1! Kd4-d3 34 Kf-e1 White can draw because the pin along the 7th rank prevents the advance of black's d-pawn.)
33 ... Kd4-d3
34 Rh4-b4 d7-d5
35 Kg1-f1 d5-d4
(The advancing mass of Black pawns is more than enough to overwhelm White's king and rook.)
36 h2-h4 Kd3-c3
37 Rb4-b1 Kc3-c2
38 Rb1-a1 d4-d3
39 Ra1-a2+ Kc2-b1
40 Ra2-a7 Rb7xb6
41 Ra7-a5 Rb6-b2
42 Ra5-a7 Rb2-f2+
43 Kf1-g1 d3-d2
(The space invaders are about to touch down.)
44 Ra7-b7+ Kb1-a2
45 Rb7-a7+ Ka2-b2
46 Ra7-b7+ Kb2-c2
(Getting the right idea second time around.)
47 Rb7-c7+ Kc2-d3
48 Rc7-d7+ Kd3-e2
49 g2-g4 d2-d1=Q+
50 Rd7xQd1 Ke2xRd1
0-1

END



Perfect Link

More executives are finding that they want to link their micros to mainframes to access both company information and popular public information systems. Peter Bright assesses Perfect Software's Perfect Link, one of a new breed of friendly comms programs.

Data processing departments don't like micros. This simple fact sums up a major problem facing medium to large companies: because DP departments don't usually want to get involved with buying micros, it's often left up to individual users to choose which micros to buy. This has resulted in companies ending up with a wide range of incompatible micros sitting on their executive's desks. The problems start when one executive decides that he would like to transfer data from a colleague's micro.

In order to transfer files you need two things — an RS232 serial port with cable, and appropriate software on each machine to control data flow.

Either of these can give you endless trouble. Although in theory the RS232 is a standard interface, in practice manufacturers use all kinds of different sizes and shapes of plugs, and sometimes they even wire the sockets incorrectly.

Also, if you are directly connecting two micros together, you will need to use a 'null modem adaptor'. This reverses pins two and three and makes sure that data transmitted from one machine ends up on the receive line of the other. Failure to do this can lead to hours of frustration trying to find out why the link won't work.

The problem with the software part of the link is that until recently, communications software hasn't been very friendly. Programs like BSTAM or ASYNC are both very popular comms packages, but are very unfriendly.

Perfect Link is designed to work on the IBM PC or IBM lookalikes (I used an Olivetti M24). The M24 has an RS232 port built in, but if you use a PC you'll need a RS232 card.

Setting up

There are two ways of setting up Perfect Link. Most day to day alterations can be done while the program is running, but if you are using an auto-dial modem you'll need to install Perfect Link using the PLINSTAL program.

Plinstal

Plinstal allows you to set up Perfect Link for use with auto-dial 'smart' modems. It also allows you to store dialling codes and log-ons for the most popular American dial-up services so that Perfect Link can automatically dial and log onto various information systems.

The problem with Plinstal is that it looks for American telephone code structures. These are not the same as those used in the UK, and I couldn't see any easy way of modifying the program to accept British codes.

Another problem is that Perfect Link was designed for use with American 'smart' auto-dial modems, none of which are legally available here. British Telecom is much more strict than Ma Bell about the specifications for auto-dial modems: American auto-dial modems dial, hang up and re-dial very fast; BT-approved auto-dial modems are much slower, therefore it's unlikely that British auto-dial modems will work properly with Perfect Link.

In use

At its simplest level, Perfect Link can be used as a normal dumb terminal to link into a remote mainframe or micro. When in this mode, the screen is divided into two sections. The top 24 lines are used to display data going to and from the remote system, and the bottom line is used as a status line.

Working from left to right along the status line we have: the connect-time clock, flags for carrier detect, printer online, interrupt (XON), and host status. In addition, there are displays for filename (if you are saving to disk), system name, terminal emulation type, and the baud rate you are using. There is a great deal of information displayed on one line, but it's easy to understand what's going on.

The connect-time clock is a surprisingly useful feature. It's easy to run up hefty phone bills when you're connected to dial-up services — the clock is an obvious reminder of how much time you're using. The clock also gives a good indication of whether the RS232 link is working properly. It seems to take its timing pulses from one of the lines on the RS232 port, so if the clock doesn't work there's something wrong with the link.

User interface

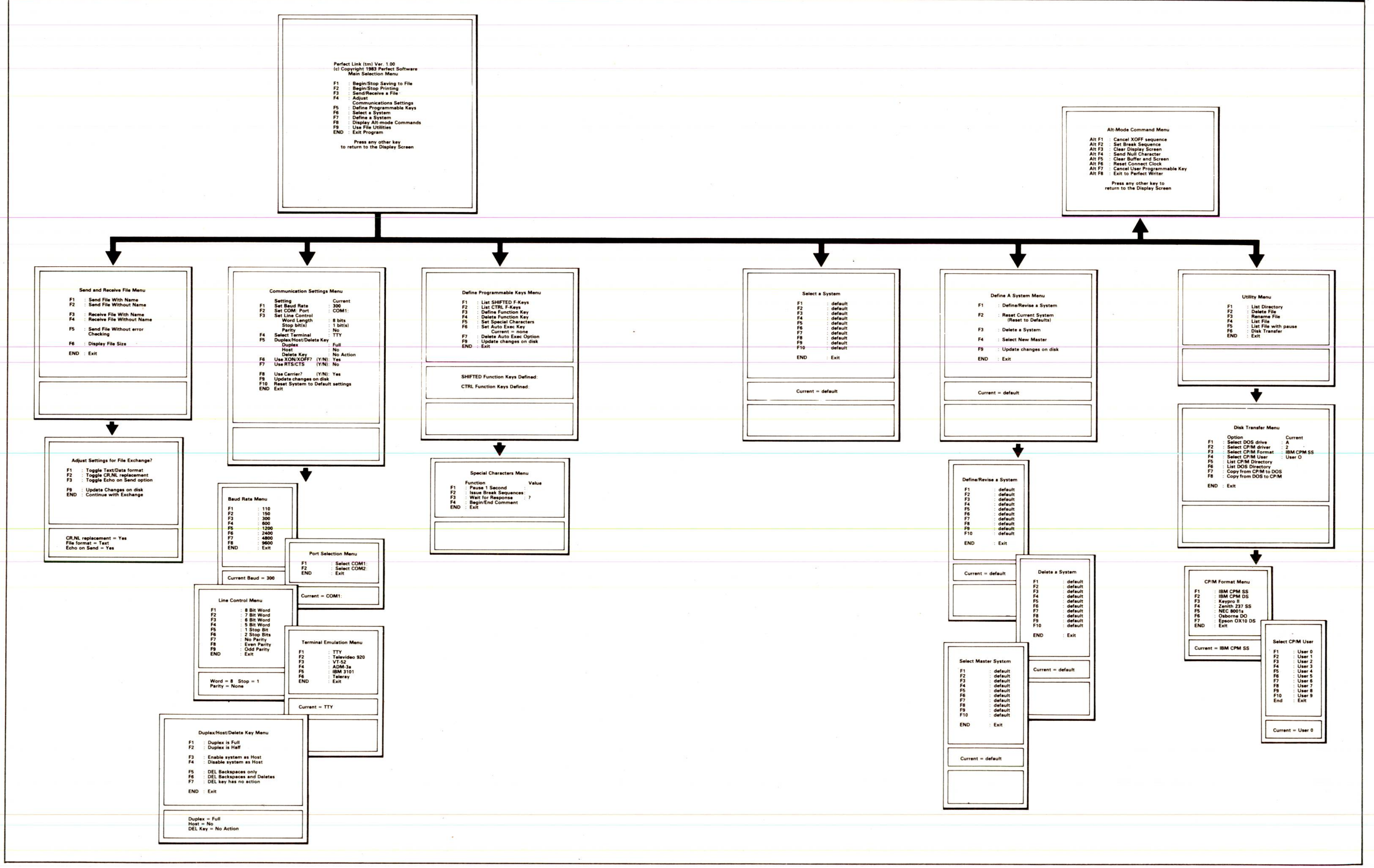
Perfect Link makes heavy use of the function keys and the 'HOME' key. Most selections can be made with a single keystroke. You can hit the 'HOME' key to call up the main selection at any time, and function keys call up more specific sub-menus. All menus are displayed in the middle of the screen. Sub-menus are displayed on top of their parents, which gives a windowing effect.

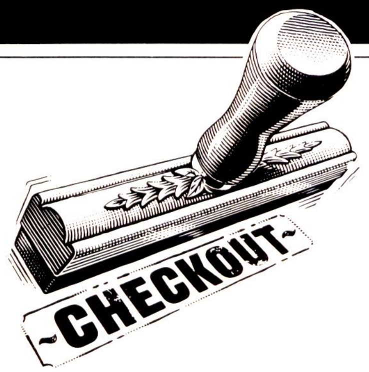
Communications settings

As you would expect from a comms program, Perfect Link makes it easy to experiment with the comms line settings. You can change the baud rate, word length, parity and stop bits, and decide if you want full or half duplex. You can also toggle XON/OFF and RTS/CTS. These are fairly standard, baud rate is switchable up to 9600 baud. The only omission is that Prestel 1200/75 baud is not supported.

Perfect Link has the ability to emulate various popular terminals. These are all selectable from the communications settings menu and comprise Televideo 920, DEC VT-52, ADM-3a, IBM 3101 and Teleray, in addition to the normal TTY terminal mode. The terminal emulation facility can be very useful when you are

The Perfect Link Menu Tree





connected to a mainframe system which was designed for non-TTY terminals.

I hooked up the machine to a wide range of dial-up services such as Telecom Gold and Prestel, and they all worked well. If you are online to a system and want hard copy of what's going on, F2 toggles the printer on and off.

XModem

As well as providing terminal emulation facilities, Perfect Link also allows you to transfer disk files to and from other micros. Most terminal packages allow ASCII text files to be transferred, but Perfect Link can also copy .COM and .EXE program files.

This is possible because Perfect Link incorporates the XModem protocols. As long as the machine you are talking to supports XModem you can transfer any disk file. Peter Tootill discusses the XModem protocol in more depth on page 170, and gives details about the technicalities.

Transferring files

When two machines are hooked directly together, it's necessary to decide which machine is host and which is the slave. If you are downloading from a remote mainframe via a dial-up line, the mainframe will usually be the host. Perfect Link can work as either host or slave.

You must then decide whether or not to use the XModem protocols. If you are transferring a program you'll need XModem, but if you are transferring text files it isn't necessary. All the XModem protocols are automatically handled by the program. The main difference between XModem and non-XModem transmissions as far as the user is concerned is that the latter are comparatively fast, whereas the former can be very, very slow.

I tried to download a program from one of the XModem-supported TBBS bulletin boards: it all went without a hitch and the program seemed none the worse for its journey. I also uploaded and downloaded text files to and from various dial-up services and these went without a hitch too.

Disk to disk transfer

One of the most interesting aspects of Perfect Link is that it claims to be able to make the IBM PC read and write disks in alien CP/M disk formats. This is potentially very useful: instead of having to link up the different micros and go through all the problems of file transfer, you just copy the file to the correct disk format inside your PC.

This option can be selected from the main menu where it's to be found under utilities. The rest of the utilities menu allows you to perform fairly mundane tasks like deleting a file, listing a directory, or typing a file. The disk to disk option is the last on the menu.

According to the manual, Perfect Link can read and write the following CP/M disk formats: IBM single-sided, IBM double-sided, Kaypro II, Zenith 237 single-sided, NEC 8001a, Osborne and Epson QX10.

Before you can copy from disk to disk, you must tell the system which disk drive the CP/M disk is in and specify which CP/M user area you want to copy from. This will usually be user 0 because this feature isn't often used on CP/M systems.

At the time I was testing this option we had an Epson QX10 in the office, so I borrowed a disk, put it in the Olivetti, set the parameters, and told it to copy a file. It failed miserably. I spent the best part of an afternoon on a guided tour of Perfect Link's error messages. At one point I thought that the problem could be that the Olivetti wasn't as IBM-compatible as I had thought, so I tried it on a real IBM. It still didn't work. In the end I phoned Perfect Software but they couldn't help, so I had to give up.

A couple of days later I had another go using Kaypro disks. This time I had much more success and actually managed to copy files to and from the Kaypro disks. In the process I found that Perfect Link is quite happy to carry on copying a file even when the disk is full; you only know that the copy has failed when you find that your file never made it to the destination disk.

Defining a system

When using Perfect Link to log on to remote systems, you might find that you are always having to change the communications settings to match the different systems. Perfect Link gets around this by allowing you to set up the default settings for up to ten different systems. Instead of messing around with all the comms settings, you hit a key and they are all automatically selected.

The process for defining a system is very straighforward and again makes heavy use of menus. Once a system has been defined, it can be called from the main menu by hitting F6 followed by the system number.

In the same way that you can define a system, you can also set up the function keys to return strings. This can be useful in a number of situations: for example, you could program SHIFTed F10 to return your user ID instead of having to type it in every time you logged onto a system. You can also embed special control characters into the string: if you were programming a sign on sequence and wanted to wait for the host computer to respond, you would embed a '?' into the string. Using this facility, you can build up some very impressive one-line mini-programs.

Documentation

The documentation is very good. It makes heavy use of cartoons and is presented as a thick typeset paperback book. The first section is a general introduction to dial-up services and Perfect Link. The following sections go through the Perfect Link functions, explaining clearly what they do. The manual's job is made easier because the system is virtually self-explanatory.

A large section of the manual is given over to explaining how to use some of the more popular American information systems, which means that the manual contains all the information needed for the first time user to learn how to use Perfect Link *and* how to use Perfect Link for dial-up services.

The services covered are: Dow Jones, CompuServe, The Source, The Official Airlines Guides, Newsnet and Knowledge Index (it's a pity that the manual hasn't been altered to include British services such as Telecom Gold).

I was impressed with the manual. It includes not only necessary information, but also presents points that are not vital but interesting. As an added bonus, it has a decent index.

Conclusion

It is becoming much more important to be able to link micros to mainframes and other micros. It is also important that the relative software is friendly and easy to use.

Perfect Link succeeds. It is certainly straightforward to use — you don't get bogged down in layers of sub-menus. The terminal emulation facilities could be very useful for linking into the company mainframe as long as Perfect Link supports the right terminal for your company.

Perfect Link does not pretend to turn your IBM into an all-singing all-dancing terminal, so those of you looking for 3270 emulation and the like will have to look elsewhere.

The XModem protocol is the nearest thing there is to a standard micro comms protocol, so its inclusion is welcome. It may not be the most secure protocol around, but it's uncomplicated and easy to use.

The most disappointing feature is the disk to disk transfer utility. If this had worked properly, it would have been a valuable bonus. END

Crystal

An easy to use micro capable of handling large databases is a welcome addition to any office. The multi-user Crystal from Aston Technology looks cut out for the job but it won't leave you much change out of £10,000. Peter Bright reports.

Conventional wisdom holds that networking is preferable to multi-user as far as micros are concerned. The problem is that the network market is in a mess, and while it stays in that state there will always be a place for the multi-user micro.

The Crystal is one of a growing range of very sophisticated multi-user micros based on the Motorola 68000 processor. It was originally designed by Pertec in the US, but now Aston Technology imports kits and assembles and distributes the machine in the UK. This machine offers high capacity, virtual memory and a choice of three operating systems — Unix, MBOS or Pick. I had a look at Pick.

Until recently little had been heard of Pick but it seems very attractive, boasting comprehensive database handling

facilities as well as ease of use.

Hardware

At first glance, the Crystal desktop looks rather boring. The whole unit is very compact, especially when you consider what it contains. The packaging does not even try to look pretty in the way that, for instance, the Apricot does. All you get is a brown box with rounded edges and a large cream plastic band around it.

The front of the system box is made of a fine mesh and is painted the same colour brown as the rest of the unit. The floppy disk and hard disk units are located in the front right-hand corner along with the reset switch which is built into the Crystal logo.

At the back, the review machine had three RS232 serial ports (one each for the two screens and one for a serial printer), and there was space for three more serial ports. The back panel also housed the power socket and on/off switch, and a 37-way D socket for the tape streamer.

Inside

Getting inside the unit is easy once you've got the knack. The back is held on by six Philips screws. Once these have been removed the panel can be moved slightly to reveal the power supply unit and the fan assembly. The fan was very noisy but also very powerful. I left the machine switched on for weeks and nothing went wrong or overheated.

In order to get any further inside, you need to prise off the PSU chassis. This can be moved to one side as long as you're careful not to pull out any of the cables leading to the back panel.

The main PCBs are plugged into a seven slot card cage, although on the review machine only six slots were available: one was obscured by a piggy-backed board. The PCBs are very closely packed, but the fan keeps plenty of air circulating.

The review machine showed signs of a great deal of patching on the PCBs. In fact, in some cases, the patch wires were bundled together because they were so thick. But, everything seemed to work well enough.

The main processor in the Crystal is the Motorola MC68000. This is widely regarded as the most powerful mass production microprocessor available. This may change in the near future as more micros become available with the Intel 80286 and 80287 chip set which is reputed to be more powerful still. The 68000 is easy to see because it's so large.

The review machine came with 512k of RAM. This can be expanded to 1.5 Mbytes on board on the desktop machine. Pick can happily operate in quite a small amount of RAM, so this should be enough for most people. Also, because the Crystal uses 'virtual memory' the amount of RAM is not as important as it would otherwise be.

No one at Aston Technology seemed to be quite sure how much ROM is in the Crystal. The general opinion is that there isn't much — probably about 4 or 8k holding some basic diagnostics along with the boot strap loader.

The review machine was supplied with a 20Mbyte hard disk, a 1Mbyte 5¼in floppy disk drive and a tape streamer unit. With the exception of the tape streamer this is very much the 'base unit'. Aston does market a machine with a 10Mbyte hard disk, but most people seem to go for the 20Mbyte system.

Aston supplied a tape streamer without a tape, so I couldn't try it out. The main use of a tape streamer is to back up hard disks, the alternative being to use floppy disks as a back-up. On the review machine that would mean over 20 floppy disks — a very slow and tedious process.

The advantage of a tape streamer is that you can back up the hard disk straight onto the high capacity tape. This is much faster and less tedious than using floppies so the likelihood is that you will back your hard disk more often — always a good thing. The disadvantage is that streamers are expensive — the 20Mbyte streamer will set you back £3125.

Video display and keyboard

The review machine was supplied with two Qume terminals. Pick is capable of supporting a wide range of terminals, so most general purpose terminals could be hooked up.

The Qume is not my favourite terminal, but a great many manufacturers are supplying it with their machinery. I can only suppose that Qume is giving them a good deal.

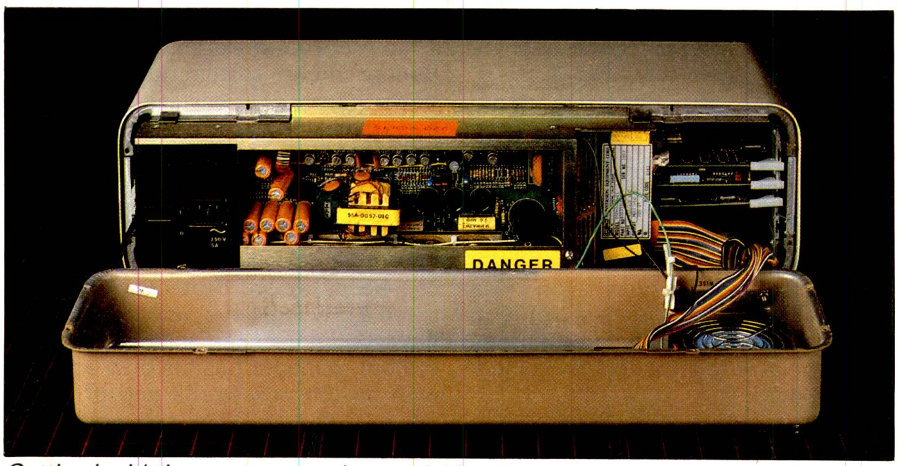
The terminal has a small base unit supporting a mediocre display, which can be tilted and swivelled to any position. The keyboard is connected to the base unit by the usual coiled cable and BT-style plug and socket.

The main problem with this terminal is the keyboard which looks and feels very cheap and nasty. In use it feels totally dead.

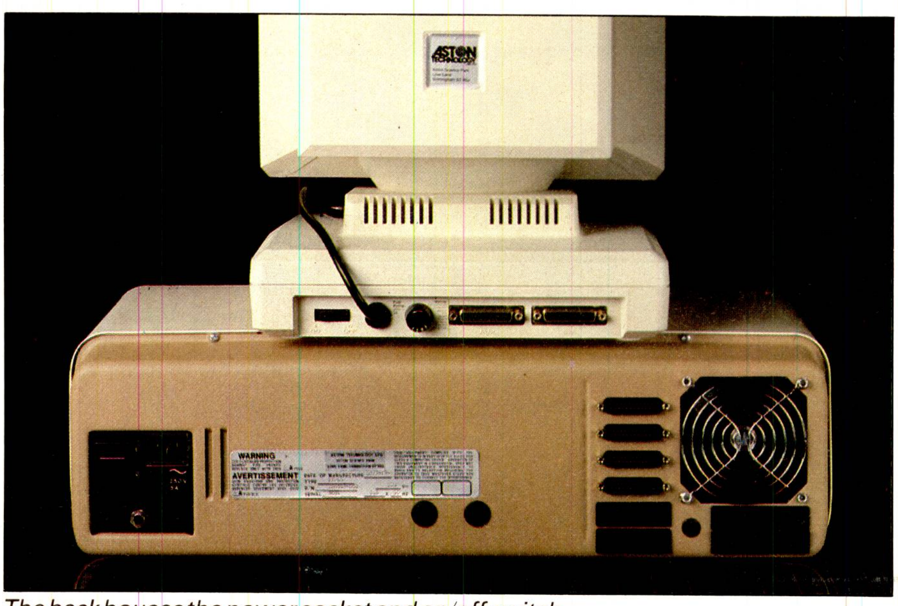
Systems software

The Crystal range is currently available with three different operating systems — Unix, MBOS and Pick. The majority of units being shipped at the moment are going out with Pick.

For much of its life Pick has been overshadowed by Unix in the small multi-user market. However, it has recently been given a great deal of



Getting inside is easy once you've got the knack



The back houses the power socket and on/off switch

publicity in the weekly computer press and more people are looking at it as an alternative to Unix on some multi-user 'super micros'.

On page 206 of this issue there's a two-part article by David O'Byrne on the concepts of Pick, so I will content myself with describing what it's like to use the system on the Crystal.

The review machine was set up for use with the 'System Builder' applications generator/database reviewed by Kathy Lang in June's *PCW*. This meant that when I logged onto the system I was greeted with a little menu rather than the more usual Terminal Control Language (TCL) '>' prompt. The TCL level is roughly like CP/M's A> prompt level.

One of the helpful things about Crystal's implementation of Pick is its shut-down option. Closing down multi-user systems can sometimes be tricky — on the Crystal it's easy.

Before switching off the power you run the shut-down procedure. This saves the contents of all the RAM to disk. When it is switched on again, the system automatically reloads the RAM image to leave you exactly where you were before you switched the machine off.

Crystal has an impressive demo program which goes round in an endless loop drawing a picture of a snake. When you close down the system the snake stops, and when you switch it back on it starts scrolling again from where it left off. This feature can be very handy because even if you close the system while people are still on, you can do so in the knowledge that they should be able to start up again where they left off.

The display can be tilted and swivelled to any position

Using Pick

Assuming that you aren't in the System Builder menu system when you sit down in front of a Crystal terminal, you can expect to be greeted with a message asking you to log-on. Each user has his own 'account' which contains all the files together with various system files, the most important of which is M/DICT. Each account can be password protected and allocated a privilege level which says what the account user can and can't do. The system manager has his own account with all the passwords and privilege details and full access to all aspects of the system.

You can exit an account either by logging off the system or by using the LOGTO verb to move to another account. When you do this, the system prints out how long you were on the system and how much processing time has been used. These records are also kept on disk for accounting purposes.

This reveals that the system started off on minicomputers where accurate accounting details are important. Another giveaway is that the system is case-sensitive, so 'PETE' is interpreted

The keyboard: 'cheap, nasty and totally dead'

as being different from 'pete'. This is very disconcerting at first but after a while you get used to doing everything in upper case; in fact, I found niggling faults like this throughout the system which definitely shows its age.

Memory

A major point to bear in mind is that the Crystal uses 'virtual memory'. This means that instead of looking at the RAM and disk as being separate, the system regards the hard disk as an extension of the RAM and addresses them both in exactly the same way. So, on a machine with 500k of RAM and a 10Mbyte hard disk, the system just thinks it has 10.5Mbyte of memory; it doesn't particularly care if it's hard disk or RAM. This is an interesting approach — it should certainly keep greedy programmers happy.

The major drawback of using a disk for main storage is that it's not as fast as RAM. Pick gets around this by shuffling data between disk and RAM as needed.

All data on the system is stored in 512 byte 'pages'. When a page is needed the system first looks in RAM. If the data isn't there it looks on the disk and pulls the page into RAM. If that page is needed again, it will now be available much faster. Pages that haven't been used recently are written back to disk (all this is transparent to the user).

On the subject of memory allocation, it is interesting to note that the operating system only takes up a very small amount of the available RAM. On a two or three user system, the operating system only uses 4 or 5k!

File storage

One of Pick's main selling points is that it's good at handling files and databases.

The first point about file storage is that Pick supports variable length files whereas most other micros only support fixed length files. On a system that only supports fixed length files, you have to allocate enough file space to accommodate the longest possible piece of data in each field even if most of your data is not that long. This means that you waste a great deal of disk space. With a variable length system the data only takes up as much space as it needs.

Memory permitting, you can have any number of files which can contain any number of records, but a record cannot exceed 32k. This is not quite as generous as it sounds. For example, it's usual to store all Basic programs in one file (normally called BP) with each program stored as a record within the file. It's conceivable that you could write a program that runs up against the 32k record size limit, but apparently the 32k constraint has been removed in the latest release of Pick.

The file structure within Pick works at four levels — at the top is the system dictionary, next the master dictionaries, then the data dictionaries and lastly the data files.

The system dictionary can only usually be accessed by the system manager. It contains all the security codes, passwords and system privileges.

'The main processor in the Crystal is the Motorola MC68000. This is widely regarded as the most powerful mass production microprocessor available.'

The next level is the master dictionaries (usually called M/DICT). Each user account has its own M/DICT which contains definitions and pointers for all the system commands. Whenever you type a command at the TCL prompt the system will look in your M/DICT to see if it can find a definition of the word you typed. If it can, it executes the command; if it can't, it gives you an error. Because all the system commands are held in this gigantic look-up file it's very easy to alter them. For example, to get a list of your files you usually type LISTFILES. I prefer DIR, so I just altered the M/DICT entry. You can have any number of M/DICT entries pointing to the same procedure, so I also created an entry called DIT (I never could type) pointing to the LISTFILES procedure. It wouldn't matter if I were to type LISTFILES, DIR or DIT, the system would still know what I was talking about. Try doing that in CP/M.

This facility could be very useful, due to each user having commands specially customised to his own specific requirements.

Each data file has an associated 'dictionary' file to describe its structure. The data file is accessed through the data dictionary. More than one data file can share the same data dictionary. This is a very flexible system making it easy to change the structure of your data.

System tools

The review machine came with four main system tools: an editor, the 'Access' processor, the 'Proc' processor and Basic.

The editor is another sign of the age of the system. It is line orientated, and uncongenial. Unfortunately, you have to stick with it to use M/DICT or to create a Basic program. However, things aren't quite as bad as they seem because a full screen editor called Jet can also be supplied.

The Access processor allows you to interrogate files to produce *ad hoc* reports or listings. Usually Basic would be used to produce regular reports.

Access is a very powerful and flexible tool for retrieving information from files. Two hundred pages of the reference manual are devoted to explaining how it works. The commands look like English and are easy to understand.

Using Access to interrogate a database is straightforward. Complex search criteria can be built into one command, sometimes making long command lines. Access also allows you to sort, break when a value changes, and total.

If you don't like a verb, you can change it. For example, the Access command to list a file is LIST; if you felt like it you could set up SHOW, PRINT, DISPLAY or even GIMME to do the same thing.

There are two main ways of 'programming' the system — either Basic or the Proc processor. Proc allows you to store a sequence of TCL commands in a file. These commands are then executed when the file is called.

This is very similar to CP/M's Submit or MS/DOS's Batch systems. However, Proc goes way beyond these by allowing conditional and unconditional branching, pattern matching, parameter passing and operator prompting. Together these mean that you can build up some fairly complex operations.

The Basic is eccentric. It's a compiled extended version of the old original Dartmouth Basic. The fact that it's compiled means that you first have to create the program with the editor, then try to compile it, then fix the bugs with the editor again, then compile it again, and then try to run it.

'Access is a very powerful and flexible tool for retrieving information from files. Two hundred pages of the reference manual are devoted to explaining how it works.'

There are two ways of running a compiled Pick Basic program. The first method is to use the RUN verb followed by the file and record names. An example would be RUN BP PETE1. Don't forget that programs are usually stored as records within a file. So, in this case, BP is the file name and PETE1 is the record (program) name.

The second way is to use the CATALOG verb. This creates an M/DICT entry for the program so that the program can be run in the same way as any other system command. The great advan-

tage is that you can create commands similar to system commands by writing a Basic program.

Anyone who is used to Microsoft Basic will find Pick Basic very strange. The first thing you notice is that it doesn't use line numbers for GOTOs, GOSUBs, and so on. Instead, it uses labels to indicate where to jump to. This is very similar to the Basic in Revelation which I reviewed (*PCW* April). The only difference is that you can only use numeric labels in Pick Basic.

Pick Basic has some very powerful disk, tape and file manipulation facilities along with the obligatory file locking facilities. This is to be expected in a system that specialises in database manipulation.

Graphics, colour and sound are not to be found in Pick Basic. This is a shame because it makes for very boring displays. More and more businesses are using colour and graphics these days, so this is a key omission.

A look at the Benchtest results will show that the machine is quick. This is only to be expected on a machine with a 68000 processor running compiled code. In Benchmark 8 Pick Basic does not support LOG, so I used LN instead.

Don't pay too much attention to the Benchmark figures. This is a multi-user machine, but the Benchmarks were run in single-user mode. As the Benchmarks are processor-intensive and don't use I/O when running, they might be expected to slow down in direct relation to the number of users running them. Just out of interest I ran them on two screens at once and they took exactly twice as long to run. This is because the system works on a straight time slice when there is no I/O.

'Pick Basic has some very powerful disk, tape and file manipulation facilities along with the obligatory file locking facilities. This is to be expected in a system that specialises in database manipulation.'

I only had a two-user system, so it's difficult to predict how the system response time will degrade as more users are added, but with two normal users there was very little appreciable degradation.

Applications software

Now we come to the problem. The review machine was not supplied with any applications software apart from the System Builder applications generator/database. I'm sure that Aston Technology and many of its dealers will use this product to create applications programs which will be available in due programs which will be available in due course, but you can't run your business on what may happen in due course.

Aston Technology says that it has a long list of applications software which has come down from mini systems. I didn't get to look at any so can't comment, except to say that mini software tends to be much more expensive than micro software. It is also often much less friendly than contemporary micro software, so try before you buy.

'There is certainly a need in many offices for a micro capable of handling large databases . . . in many ways the Crystal fits the bill.'

As Pick is not a mainstream operating system, it may be quite a while before the all important independent software vendors make any of their products available under Pick. Again be wary.

Documentation

The documentation was not good: it consisted of about 700 pages of computer listing. All the documentation is held on the system, and Aston Technology ran off a copy for me.

The manual was comprehensive and relatively easy to follow. I managed to find what I was looking for; the only problem was that in the process I usually dropped 500 pages all over the floor!

Aston Technology says it is working on user documentation which will be typeset and bound.

Prices

An entry level system with a 10Mbyte hard disk and four serial ports costs £7490. To this you must add the cost of terminals — the Qume terminals are £775 each.

The system with a 20Mbyte hard disk and four ports costs £8215. This doesn't make it particularly cheap — even by multi-user standards. The tape streamer will set you back an extra £3125.

Conclusion

This system has a great deal to recommend it. It also has a number of drawbacks.

Pick is sold as a system incorporating powerful database handling facilities and which is friendly to use. It certainly has some excellent database handling features and, in the main, is friendly to use. The trouble is that it does show its age in some areas, such as the line editor and its case dependency. I'm sure it was friendly in its day, but it needs bringing up to date for the micro market.

There is certainly a need in many offices for a micro capable of handling large databases and yet remains easy to use. In many ways the Crystal fits the bill. There is still debate as to whether multi-user micros have enough power to give an adequate response time when under load. The Crystal seems to do better than most in this respect, but I would think hard before hooking up more than three or four terminals to the system.

On the software front you can either accept what Aston Technology offers or take System Builder (which is very powerful) and generate your own programs.

All in all I like this system. It gives you a choice of three operating systems (Pick, Unix and MBOS) which dominate the multi-user market. If you want a multi-user machine, give the Crystal a look. END

Benchmarks

BM1	0.7
BM2	1.7
BM3	4.6
BM4	3.9
BM5	4.3
BM6	7.7
BM7	13.6
BM8	18.7
Average	6.9

All timings in seconds. For a full listing of the Benchmark programs, see 'Direct Access'.

Technical specifications

CPU	Motorola MC68000
RAM	Review machine 512k expandable to 1.5Mbyte
ROM	4-8k bootstrap
Terminals	Qume on review machine, but most terminals should fit
I/O	Multiple RS232
Operating systems	Pick, MBOS, Unix

Rapid access

How many micro users out there, working in large data processing departments, wish they were more effective in solving the small, everyday problems encountered by the typical user department? DB Piper suggests an in-house Information Centre to provide end users with the required personal computing facilities.

Suppose that all you want to do is 'take this print, turn it around a bit, knock out the page, re-sort the rest and sub-total here instead of there'. In comes the Systems Analyst, who talks for an hour and concludes the whole discussion with the words: 'About £2000 and six months time, sign here . . .'

This type of interchange creates the typical concept of a slow corporate data (DP) department, very expensive and incapable of providing answers at all. Small wonder then that many large companies find microcomputers being used in rapidly increasing numbers.

Problems

The problems which this uncontrolled use of micros can create are sometimes hard to visualise from the departmental point of view. On a corporate basis, it will be desirable to maintain at least a monitoring role, if not some form of active control, of the micros being introduced, allowing rationalisation of the data being held and maintained (reducing the risks of inconsistencies in the data), and preventing users reinventing the wheel.

Users are unlikely to accept this interference (as many will see it) with any relish, and the DP department may not even be consulted during the introduction of a new micro. The worst possible situation arises when all communication stops between the user and the DP department; users will be unaware of existing facilities which may fulfil their requirements, and the DP department will fail to recognise the increasing demand for 'personal computing'.

The requirements which the DP department must fulfil to make a success of personal computing on a corporate basis are:

1 To be seen as an approachable centre of expertise on methods, and on hardware and software.
2 To find a method of spreading this expertise among the end users without alienating them.
3 To provide education to users on 'how to do it', and on designing efficient solutions to problems.

The concept being put forward as the solution for this problem is that of the 'Information Centre' (IC). In order not to be classed under the same banner as the rest of the DP department, the IC must be visibly separate from it (although functional links must exist and be maintained.

The IC must have a high profile and be visible to end users.

Help, education & support

The IC is made up of three major parts. The Help Desk provides a point of contact for end users. Personnel have minimal technical expertise, but act as a distribution and monitoring point for problems.

The Education Team is responsible for running all educational courses, ranging from simple introductory seminars designed to raise user awareness of computers and their capabilities, to advanced courses designed to teach users how to design and write their own systems. Seminars are also run by the Education Team for departmental managers to illustrate how personal computing can be used effectively in their own departments.

Support is the third major area provided by the IC. The Support Group gives advice and expertise to end users wishing to implement their own systems. Programming support can also be provided, but users are encouraged to do their own programming as much as possible. Technical Support is provided by other personnel within the Support Group, providing information on potential problem areas, new facilities and features, and how to use existing facilities more effectively.

A major feature of the IC is 'Vertical Integration' — the IC is designed to facilitate personal computing of all kinds, from systems implemented on micros to personal computing on mainframes, providing a single source of expertise.

'Copy Management' can be broadly defined as the controlled copying of data from one place to another. Users with micro-based systems will wish to access data from existing mainframe systems. Re-keying data already resident on one computer system is inefficient, but happens frequently in an uncontrolled environment. The important facets of copy management are:

Security: only authorised users should be allowed to copy data from the mainframe databases.
Sources: data for one user may be collected from a variety of sources on the mainframe.
Frequency: a user may require data to be refreshed once a month, or on a daily basis. If access is to be more frequent than this, then direct access to the data is a better solution.
Formats: with the variety of data formats used by micros and micro packages, attention must be paid to the format of the copied data.

Hardware integration exists now, but why not take the whole process a step further and include software integration? The major advantage of this concept is that a user only has to learn one set of rules to access data rather than two or three. Several producers of the 'fourth generation' languages (English-like data extract/query languages) are already experimenting with this approach.

The Information Centre is a facility being introduced by many data processing departments to provide end users with the personal computing facilities they require. By providing these in a controlled manner, efficiency can be increased without decreasing the rate of response to end users. The facilities are provided centrally, ensuring effective, consistent support for both hardware and software.

Facilities can be made available either on micros or mainframe computers, or both. Advances in hardware and software will give rise to integrated environments on all sizes of computers, which will further encourage the use of microcomputers in large businesses. In the longer term, intelligent communications between micros and mainframes will allow users to access mainframe data as though it were resident on their own micro. END

It's difficult to say exactly how many programs there are for the IBM Personal Computer.

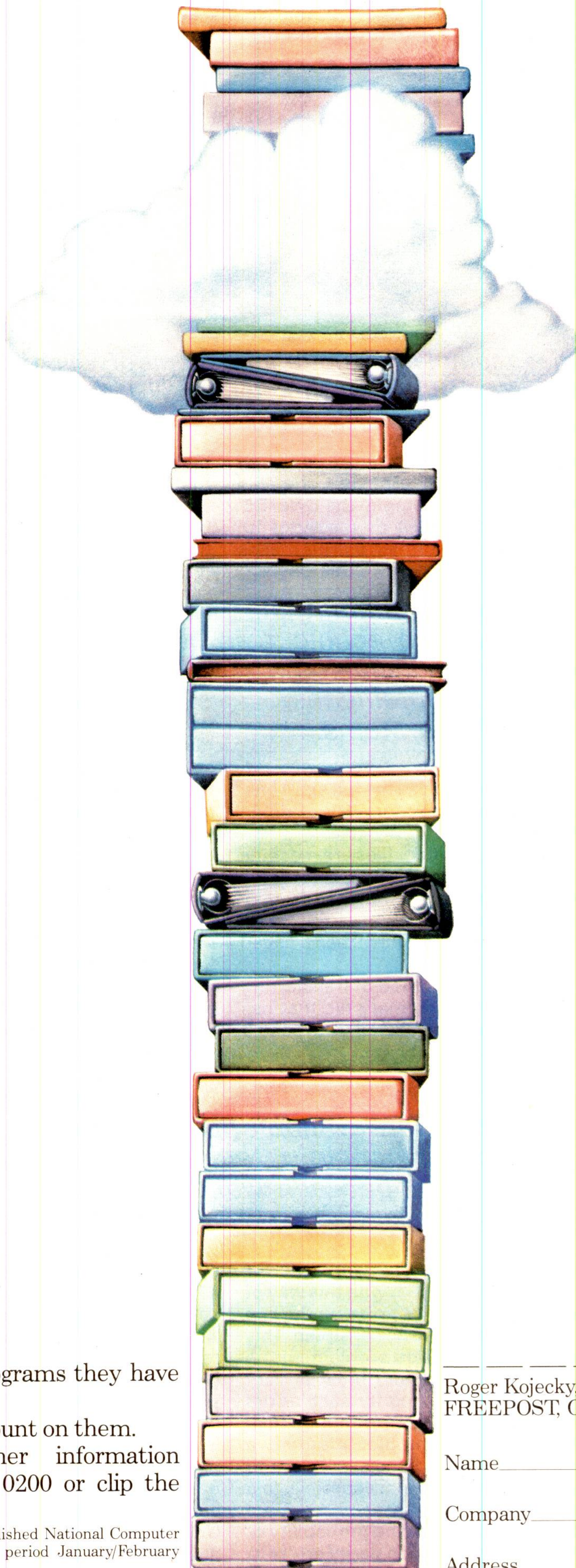
New ones are being added to the extensive library every day.

Which means that, however unusual your business may seem, we can probably offer you software that matches your personal needs.

As you'd expect, software for the IBM Personal Computer covers every everyday business function (accounts, sales forecasting, word processing and so on.) As you probably wouldn't expect, it also covers a whole spectrum of less obvious areas.

With specific programs for subjects as diverse as gem-cutting and plant-breeding.

Your local IBM Authorised Dealers or Retail Centres will show you how many IBM Personal



Computer Programs they have for you.

You can count on them.

For further information phone 01-200 0200 or clip the coupon.

*Based on published National Computer Centre data for the period January/February 1984.

Roger Kojecky, IBM United Kingdom Product Sales Limited, FREEPOST, Greenford, Middx. UB6 9BR. (Tel: 01-578 4399.)

PCW 7/84

Name________ Position________

Company________

Address________

IBM

Modem protocols

Micro communications has a complex etiquette, an example of which is the XModem, as developed by Ward Christensen. Peter Tootill describes this method of transferring data.

As many people will already be aware, there has been a tremendous increase in the number of computer bulletin boards recently. The number of situations where two or more computers are available has grown rapidly, and both these facts have led to an increasing interest in the transfer of files between two computers.

There are several methods of doing this, whether via the telephone system or by connecting the RS232 ports together (remembering to use a 'null modem' or to reverse pins two and three at one end of the connection).

'. . . . set of protocols for improving the reliability of transmission of data by using a checksum technique was developed by Ward Christensen for inclusion in his 'Modem' and 'XModem' series of intelligent terminal programs written for CP/M systems.'

Files

One of the most important considerations is the type of file that you wish to send across. There are two main types, usually referred to as 'binary files' and 'ASCII files'. The latter are files that contain nothing but printable characters from the standard ASCII 7-bit alphabet. A list of ASCII codes (in your computer's manual, for example) will provide codes between 32 and 127, plus carriage return and linefeed.

The simplest type of ASCII file is ordinary text (the text of this article, for example) without any special printer control codes of the type that can be inserted by some word processing packages. Any file that contains other characters (that is, characters whose ASCII code is over 127) is usually called a binary file. The distinction is quite important, as ASCII files can be transferred between systems by using the common standard word length of seven bits. Binary files will need eight bits for transfer. It's possible to translate a binary file into an ASCII file by translating each byte into two printable characters. For example, the byte 'D6' (hex) would be sent as the letter 'D' followed by the number '6'. This means that the transfer takes twice as long as it would if we could use the full eight bits, but it's a very common way of doing things.

Examples of binary files are machine code and Basic programs that use a tokenised form of the Basic keywords, that is, Basic programs from most micros unless they have been saved with an ASCII option.

The simplest method of transferring an ASCII file (or a binary file that has been translated into ASCII) is to send it one character at a time with no error checking. The problem with this way of doing things is that a noise on the line can cause the data to be corrupted. This may not be a serious problem with a text file, as the human brain is very good at compensating for such errors from clues in the surrounding text. However, in a computer program a small error could be disastrous and may not be easy to find, especially in a machine code program.

One way to reduce the probability of such errors is to rely on parity errors to highlight corrupted characters. A better method is to transmit the file in blocks, and to calculate the 'checksum' of each block by adding all the ASCII values in the block. The receiving computer requests retransmission if the checksum it calculates doesn't agree with that sent by the transmitting system. This is not a complete solution as it's possible for errors to compensate for each other and still produce the correct checksum, even though the data is wrong. It is, however, widely used and generally produces very reliable results. More advanced methods use more complex checks on the data, and can give virtually 100% error free transmission.

Protocols

One particular set of protocols for improving the reliability of transmission of data by using a checksum technique was developed by Ward Christensen for inclusion in his 'Modem' and 'XModem' series of intelligent terminal programs written for CP/M systems. (These are available from the CP/M user group library, the latest versions being Modem 7.65 and XModem 5.0.) These protocols, often referred to as 'CP/M' or 'XModem' protocols, have been applied to other sytems and have become widely used in North America. They have been incorporated in many smart terminal packages and are normally supported by bulletin boards, including the TBBS and CBBS systems which operate in the UK. They provide much more reliable downloading of programs than would

'The number of situations where two or more computers are available has grown rapidly, and has led to an increasing interest in the transfer of files between two computers.'

otherwise be possible. There is also at least one package for the BBC Micro that supports them. The protocols use an 8-bit standard (with no parity), and can transmit machine code files without the need to translate them into ASCII code first.

The protocols are 'in the public domain' and no licence fees are required to use them (see Fig 1 for details). If you are writing terminal software, I strongly recommend that you consider including support for XModem protocols in the package.

<soh>	01H
<eot>	04H
<ack>	06H
<nak>	15H
<can>	18H

Fig 1 Protocol definitions

The protocols work at three levels — transmission level, message block level, and file level.

Transmission level

Data format: asynchronous, eight data bits, no parity, one stop bit.

There is no restriction on the contents of the data being transmitted. Any kind may be sent — binary, ASCII, and so on. To maintain compatibility with the CP/M file structure — that is, to allow the transfer of ASCII files to or from CP/M systems — the files should adhere to the following:

* ASCII tabs used (09H): tabs set every nine characters.
* Lines should be terminated by CR/LF (0DH 0AH).
* End-of-file should be indicated by one or more Control-Zs (1AH). (A CP/M peculiarity is that if the data ends exactly on a 128-byte boundary, a subsequent sector containing the Control-Z EOF character(s) is optional, but is preferred. Some programs still do not handle EOF without Control-Zs.)
* The last block sent is not different in any way from others: there is no 'short block'.

Message block level

Each block of the transfer looks like the following:

<SOH><blk no><255-blk no><..128 data bytes..><chksum>, in which:

<SOH> = 01 hex.

<blk no> = block number, starts at 01H, increments by one, and wraps from 0FFH to 00H (not to 01).

<255-blk no> = the 'one's complement' of the block number: that is, each bit in the 8-bit block number complemented with itself. (For example, the block number after going through the 8080 'CMA' instruction.)

<cksum> = the sum of the data bytes only, ignoring any carry.

File level

a) Common to both sender and receiver: all errors are retried 10 times. For versions running with an operator, a message is output on the terminal after 10 errors asking the operator whether to 'retry or quit'.

Some versions of the protocol use ASCII <can> (Control-X) to cancel transmission. This is undesirable, as having a single 'abort' character makes the transmission susceptible to false termination due to corruption of a control byte.

b) At the receive end: the receiver has a 10-second timeout. It sends a <nak> every time it times out. The receiver's first timeout, which sends a <nak>, signals the transmitter to start. (Optionally, the receiver could send a <nak> immediately, in case the sender is ready. This would save the initial 10-second timeout. However, the receiver must continue to timeout every 10 seconds in case the sender wasn't ready.)

Once into receiving a block, the receiver changes to a one second timeout for each character and the checksum. If the receiver wishes to <nak> a block for any reason (invalid header, timeout, and so on) it must wait for the line to clear.

Synchronising: if a valid block number is received, it will be:

1 The expected one, in which case everything is fine.

2 An unexpected repeat of the previously received block. This should be considered OK, and only indicates that the receivers <ack> became corrupted, and the sender re-transmitted.

3 Any other block number indicates a fatal loss of synchronisation, such as the rare case of the sender getting a line-glitch that looks like an <ack>. In this case the transmission is aborted, either by sending a <can> or by waiting for a timeout.

c) At the senders end: while waiting for transmission to begin, the sender needs only a single, long timeout (one minute, for example). In most implementations, the sender has a 10-second timeout before retrying, but this is not necessary as the protocol can be completely receiver-driven; this will be compatible with existing programs. When the sender has no more data, it sends an <eot> and awaits an <ack>, resending the <eot> if it doesn't get one.

A sample of the data flow, sending a three-block message, is shown in Fig 2. It includes the two most common line problems — a corrupted block, and an <ack> reply getting corrupted. <xx> represents the checksum byte.

```
SENDER                RECEIVER
              times out after 10 seconds
        ← <nak>
  <soh> 01 FE –data– <xx> →
        ← <ack>
  <soh> 02 FD –data– <xx> → (data gets corrupted)
        ← <nak>
  <soh> 02 FD –data– <xx> →
        ← <ack>
  <soh> 03 FC –data– <xx> →
        ← <ack> (but <ack> gets corrupted)
  <soh> 03 FC –data– <xx> →
        ← <ack>
          <eot> →
        ← <ack>
```

Fig 2 Data flow sending three-block message

'One of the most important considerations is the type of file that you wish to send across. There are two main types, usually referred to as "binary files" and "ASCII files".'

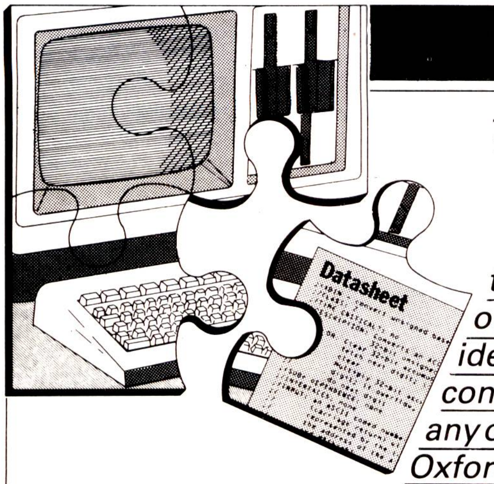
Programming hints

The character-receive subroutine should be called with a parameter specifying the number of seconds to wait. The receiver should first call it with 10, then <nak> and try again, 10 times. After receiving the <soh>, he should call the character receive subroutine with a one-second timeout for the remainder of the message block and the <cksum>. As they are sent as a continuous stream, timing out of this implies a serious line glitch that can cause 127 characters to be seen instead of 128, for example.

When the receiver wishes to <nak>, it should call a 'purge' subroutine to wait for the line to clear. The sender should ignore any characters in its UART buffer immediately upon completing the sending of a block, to ensure that no glitches were misinterpreted.

The most common technique is for 'purge' to call the character receive subroutine, specifying a one-second timeout, and looping back to purge until a timeout occurs. The <nak> is then sent, ensuring the other end will see it. END

SUBSET



This is your chance to help build a library of general-purpose routines, documented to the standards developed by Alan Tootill and David Barrow in this series. The documentation enables you to use the routines, even if you don't understand the code. You can contribute a Datasheet, improve or develop one already printed or translate the implementation of a good idea from one processor to another. PCW *will pay for those contributions that achieve Datasheet status. Contributions (for any of the popular processors) should be sent to SubSet,* PCW, *62 Oxford Street, London W1A 2HG.*

As the old brigade of Z80 and 6502 squeezed out the 6809 last month, this month we have four routines for the 6809 and one for the NS16000. Never heard of it? Read on and see just how sophisticated assembly language is becoming.

Hexadecimal print

DHEX and BHEX (one routine, two entry points) from Jeff Shepherd of Littleborough prints the contents of the double-byte register D (a combination of A as high byte and B as low byte) as four hexadecimal digits, if entered at DHEX. If it is entered at BHEX, just the two digits of the B register are printed.

All four of this month's 6809 routines need a subroutine which will print an ASCII character input in an accumulator. DHEX is the odd one out, as it sends the character in the B accumulator. The other routines use A.

If anyone considers it worth rewriting DHEX to make it conform to the use of the A accumulator as the primary I/O register, you could make use of the 6809's DAA (Decimal Adjust A) instruction. If A is used, the 8-byte binary nibble to ASCII Hex (11th to 14th instructions in DHEX) can be replaced by the following 6-byte method:

```
ADDA #$90   :  8B 90
DAA         :  19
ADCA #$40   :  89 40
DAA         :  19
```

Datasheet

```
;= DHEX & BHEX  -  Print the hex value from D or B.
;/ CLASS:  1
;/ TIME CRITICAL?:  No.
;/ DESCRIPTION:  Prints the binary value (unsigned) of D or B
;/               in hexadecimal.
;/               Entry at DHEX:  prints D.
;/               Entry at BHEX:  prints B.
;/ ACTION:    Repeat twice:
;/            Swap A and B, printing A 1st time, B second
;/            Rotate right B high digit into B low nibble
;/            Save B on stack
;/            Change B high nibble to ASCII code
;/            Go print ASCII hex
;/            Recover B from stack
;/            Rotate right B to restore low digit to low nibble
;/            Save, convert, print and recover as for high digit.
;/ SUBr DEPENDENCE:  PRASCB, a subroutine to print the ASCII
;/                   character in B.  It must not change A.
;/ INTERFACES:  None.
;/ INPUT:     for DHEX: unsigned 16-bit number in D.
;/            for BHEX: unsigned 8-bit number in B.
;/ OUTPUT:    Number printed. A & B unchanged.
;/ REGs USED:  A B CC
;/ STACK USE:  S:  8 + that used by PRASCB.
;/             U:  None.
;/ LENGTH:   28
;/ PROCESSOR:  6809
```

```
;
DHEX   BSR   SWAP         ;repeat SWAP twice to        8D 00
SWAP   EXG   A,B          ;do A first, then B, in B.   1E 89
BHEX   BSR   ROLL         ;rotate so first high        8D 01
       RORB               ;digit, then low digit is    56
ROLL   RORB               ;shifted to low nibble B     56
       RORB               ;                            56
       RORB               ;                            56
       RORB               ;                            56
       PSHS  B,CC         ;save all bits.              34 05
       ANDB  #%00001111   ;mask out high nibble        C4 0F
       ADDB  #$30         ;and convert to ASCII        CB 30
       CMPB  #$3A         ;adjusting for letter        C1 3A
       BLO   NUM          ;digits.                     25 02
       ADDB  #7           ;                            CB 07
NUM    JSR   PRASCB       ;go print it.                BD XX XX
       PULS  PC,B,CC      ;restore and return.         35 85
```

Message builder

One thing that may have struck you about DHEX is that most of the action occurs inside a twice-nested, fall-into subroutine. This type of programming for twice-performed actions is quite common and natural in 6809. Because of the branch to subroutine instruction, it is also a SubSet Class 1 operation.

MAKMSG from George Perkins of Liverpool is recursive — it calls itself from the inside rather than fall into a part just called. MAKMSG is a straight translation into 6809 of a Z80 original which appeared in SubSet in September 1983. Straight, that is, except that the program relative BSR makes it relocatable; the Z80 original had to use the direct addressing CALL instruction. The 6809 MAKMSG fails to make Class 1 only because it corrupts D and CC.

MAKMSG works by testing each character picked up. If the character is valid ASCII (including control codes) then it is printed. If it's higher than 127, the next two bytes are taken as the address of a sub-message to be inserted in the message. A null (0) byte terminates any message or sub-message.

Checking the 6809, MAKMSG has brought up one error in the documentation of the original Z80 version. The stack use should read: 4 * number of sub-messages + 2 + WRCHAR stack use.

Datasheet

```
;= MAKMSG - 6809 Message assemble and print routine.
;/ CLASS:  2  (corrupts register contents).
;/ TIME CRITICAL?:  No.
;/ DESCRIPTION:  Recursive procedure to assemble and print
;/               messages composed of ASCII characters and
;/               sub-messages.
;/ ACTION:   IF character picked up is a null (0) THEN exit
;/           ELSE IF character is ASCII THEN print it, get next
;/           ELSE get escape address and re-call MAKMSG.
```

```
;/ SUBr DEPENDENCE:  PRASCA, a subroutine to print the ASCII
;/                   character in A without corrupting X.
;/ INTERFACES: RAM containing messages.
;/ INPUT:      X addresses the first byte of the top level
;/             message.
;/ OUTPUT:     X addresses the byte following the top level
;/             message terminator.  Message printed.
;/ REGs USED:  X A B CC U
;/ STACK USE: S: 2 * no. of sub-messages + 2 + PRASCA stack use.
;/            U: 2 * no. of sub-messages.
;/ LENGTH:     25
;/ PROCESSOR:  6809
;
MAKMSG  LDA  ,X+       ;pick up next byte and             A6 80
        TSTA           ;test for =0, or >127.             4D
        BEQ  RETURN    ;exit level if null byte.          27 13
        BPL  MKMSG1    ;go print valid ASCII.             2A 0C
        LDD  ,X++      ;get escape address, bump          EC 81
        PSHU X         ;point and save it for return      36 10
        TFR  D,X       ;index next level message          1F 01
        BSR  MAKMSG    ;recurse to print sub-message      8D F1
        PULU X         ;restore this level pointer        37 10
        BRA  MAKMSG    ;and go get next byte.             20 ED
MKMSG1  JSR  PRASCA    ;go print character                BD XX XX
        BRA  MAKMSG    ;and go get next byte.             20 E8
RETURN  RTS            ;exit this level / end.            39
```

Program-embedded text

Building up long messages from nested sub-messages is OK if you have to squeeze a lot of text into a little space. For short messages, it's often easier to embed them in the program, right after the call to the subroutine which will deal with them.

This neat idea first came to SubSet's notice in August 1981 with a Z80 routine (which didn't save registers) from JS Linfoot. A 16-byte improvement, saving registers, from Andrew Bain followed in November of that year. It wasn't until August 1983 that Andrew Johnson showed us how to do it for the 6502 in 31 bytes with TEXT.

We have two PET routines for the 6809. TEXTS (S for short) is from thirteen-year-old Jonathan Marsh of Runcorn. TEXTQ (Q for quick) is from GC Wraith of Kingston-by-Lewes. The slightly quicker TEXTQ, which also preserves its register contents, achieves the extra speed by knocking an unconditional branch out of the central iteration (Fig 1) while TEXTS keeps it in (Fig 2).

TEXTQ also shaves off one cycle and one byte, by assuming that the ASCII character print subroutine it calls can be addressed in the Direct Page mode. Fair play?

Both TEXTS and TEXTQ will work through the message, one byte at a time, until they come to a null (0) teminator, at which point they return to the byte after the terminator. For both routines, the message can be embedded as:

```
JSR   TEXTS (or TEXTQ)
FCC   'message
FCB   0
(program continues here on return).
```

Datasheet

```
;= TEXTS - 6809 Program embedded text printer (short).
;/ CLASS: 2 (registers corrupted).
;/ TIME CRITICAL?: No
;/ DESCRIPTION:  Prints message stored in the calling program
;/               immediately after JSR TEXTS and ending with 0.
;/ ACTION:    Move return address into X.  Get character into
;/            A using X as auto-incrementing pointer.  If
;/            character is a null (0) then transfer X to PC by
;/            indexed jump, causing a return to location after
;/            message terminator.  Else print character and repeat.
;/ SUBr DEPENDENCE:  PRASCA, a subroutine to print the ASCII
;/                   character in A without corrupting X.
;/ INTERFACES:  None.
;/ INPUT:     Text after JSR TEXTS ending with a null.
;/ OUTPUT:    Text printed, program resumed.
;/ REGs USED:  X A CC
;/ STACK USE: S: 0 + PRASCA stack use.
;/            U: None.
;/ LENGTH:    13
;/ TIME STATES: 19 + chars * (20 + PRASCA time)
;/ PROCESSOR:  6809
;
TEXTS   PULS X      ;return address to X as point     35 10
LOOP    LDA  ,X+    ;next char and bump point         A6 80
        BEQ  DONE   ;end on a null.                   27 05
        JSR  PRASCA ;else go print character          BD XX XX
        BRA  LOOP   ;then go get next.                20 F7
DONE    JMP  ,X     ;resume program after message.    6E 84
```

Datasheet

```
;= TEXTQ - 6809 Program embedded text printer (quick).
;/ CLASS: 1
;/ TIME CRITICAL?: No.
;/ DESCRIPTION:  Prints message stored in the calling program
;/               immediately after JSR TEXTQ and ending with 0.
;/ ACTION:    Save registers.  Move return address into X.  Get
;/            character into A using X as auto-incrementing
;/            pointer.  If character is not a null (0) then
;/            print it and repeat.  Else restore new return
;/            address to stack, restore registers including PC
;/            thus returning to location after text terminator.
;/ SUBr DEPENDENCE:  PRASCA, a subroutine to print the ASCII
;/                   character in A without corrupting X.
;/ INTERFACES:  None.
;/ INPUT:     Text after JSR TEXTQ ending with a null.
;/            DP contains page number where PRASCA is located.
;/ OUTPUT:    Text printed, program resumed.
;/ REGs USED:  DP CC
;/ STACK USE:  S:  5 + PRASCA stack use.
;/             U:  None.
;/ LENGTH:    16
;/ TIME STATES:  42 + chars * (16 + PRASCA time)
;/ PROCESSOR:  6809
;special notation: PP represents PRASCA location on DP page.
TEXTQ   PSHS X,A     ;Save registers used and get      34 12
        LDX  3,S     ;return address to X as point     AE 63
        BRA  GETCH   ;jump into loop to get char       20 02
LOOPQ   JSR  PRASCA  ;go print character and           9D PP
GETCH   LDA  ,X+     ;get next char, bump point        A6 80
        BNE  LOOPQ   ;go print if not terminator       26 FA
        STX  3,S     ;else replace inc'd return        AF 63
        PULS PC,X,A  ;address. Restore and return.     35 92
```

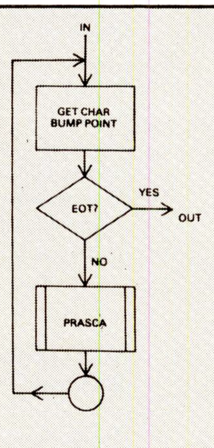


Fig 1

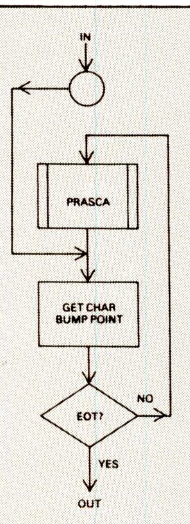


Fig 2

6502 revival

The rapidly changing world of technology means that processors quickly become anachronistic. One such example is the 6502. Although still a satisfactory performer, it looks a bit jaded in the light of recent developments. Simon Taylor and Bob Watford explain how Rockwell International has given it a 'facelift'.

The 6502 microprocessor has been with us for a good few years now; reputable computers using the 6502 include the first 'Personal Computers', the PET and the Apple II, and more recently the Oric, VIC-20 and the BBC Micro.

This fine old workhorse sometimes looks a little jaded compared to some of the more recent developments such as the 68000 and even the 6809 and could do with something of a 'facelift'.

Rockwell International, one of the manufacturers of the 6502, has recognised the need for a 6502 facelift and produced a new, pin-compatible, instruction-compatible 6502 processor.

The R65C02, as it is called, is manufactured in CMOS technology which gives it some distinct advantages over NMOS:

(1) Power consumption at 1MHz is only 20mw compared with the NMOS consumption of 450mw. This will also allow battery-run computers to be designed using the new CMOS peripheral chips.

(2) CMOS also has a far better tolerance to supply voltage and, of course, better noise immunity.

(3) CMOS, due to its lower power consumption and heat dissipation, makes possible a more compact architecture, which, in turn, has allowed Rockwell to add more instructions to the CPU.

Using an R65C02

Let's look at these extra instructions and various methods of utilising an R65C02 in an existing micro (Fig 1).

Zero page indirect and indirect indexed by X are totally new addressing modes. In the zero page indirect mode, the second byte contains a zero page address containing the 16-bit address that gives the effective address. Indirect indexed by X takes the second and third bytes of the instruction and adds these to the X register to give the effective address. This is useful for implementations of jump tables.

The most significant digit will change in the opcode to give the bit being tested: that is, the opcode for SMB 2 is A7.

Many 6502 programs will contain sequences such as:

```
TXA
PHA
TYA
PHA
```

to save the index registers on the stack, or

```
LDA $00
ORA £$01
STA $00
```

to set a bit in a particular byte in zero page.

The above examples use four bytes and 10 clock cycles, and six bytes and eight clock cycles respectively.

With the 65C02, however, these become:

```
PHX
PHY
```

and

```
SMB 0,$00
```

These are equivalent program sequences performing exactly the same function, but they do not destroy the accumulator. They also use only two bytes each and six and five clock cycles

(courtesy Rockwell International).

Hex	Mnemonic	Addressing mode	Description
72	ADC	ZP Indirect (1)	Add memory to accumulator with carry
32	AND	ZP Indirect (1)	AND memory with accumulator
OF-7F	BBR (2)	Zero page	Branch on bit reset
8F-FF	BBS(2)	Zero Page	Branch on bit set
3C	BIT	Absolute,X	Test memory bits with accumulator
34	BIT	Zero page,X	
89	BIT	Immediate	
80	BRA	Relative	Branch relative always
D2	CMP	ZP Indirect (1)	Compare memory with accumulator
3A	DEC	Accumulator	Decrement accumulator
52	EOR	ZP Indirect (1)	EXOR memory with accumulator
1A	INC	Accumulator	Increment accumulator
7C	JMP	Indirect,X (1)	Jump
B2	LDA	ZP Indirect (1)	Load accumulator with memory
12	ORA	ZP Indirect (1)	OR memory with accumulator
DA	PHX	Implied	Push X on stack
5A	PHY	Implied	Push Y on stack
FA	PLX	Implied	Pull X from stack
7A	PLY	Implied	Pull Y from stack
07-77	RMB (2)	Zero page	Reset memory bit
F2	SBC	ZP Indirect	Subtract memory from accumulator with borrow
87-F7	SMB (2)	Zero page	Set memory bit
12	STA	ZP Indirect	Store accumulator in memory
9C	STZ	Absolute	Store zero
9E	STZ	Absolute,X	
64	STZ	Zero page	
74	STZ	Zero page,X	
1C	TRB	Absolute	Test and reset memory bits with accumulator
14	TRB	Zero page	
0C	TSB	Absolute	Test and set memory bits with accumulator
04	TSB	Zero page	

Fig 1 Opcodes

respectively. Hence, on most operations, savings of memory space and program execution time can be achieved.

The main problem, however, when writing software for this processor is that the new opcodes are not included in the existing assembler! This can be solved by using .BYTE operands for all but the branch instructions, or, in the case of the BBC Micro, new functions can be defined for the new opcodes and the OPT directive can be used.

> *'Rockwell International, one of the manufacturers of the 6502, has recognised the need for a 6502 facelift and produced a new, pin-compatible, instruction-compatible 6502 processor.'*

Implementation

To fit an R65C02 in your computer, you must first check the machine's running speed.

The following table will tell you what type of R65C02 to obtain for the relevant speeds:

1MHz R65C02P1
2MHz R65C02P2
3MHz R65C02P3
4MHz R65C02P4

So, for a BBC Micro you will need an R65C02P2.

1- and 2MHz versions are available now, and 3- and 4MHz versions will be available later this year.

Rockwell distributor, RCS Microsystems has put together a pack for BBC Micro owners consisting of an R65C02P2, a listing of a program enabling the new opcodes to be used in the BBC assembler (Fig 2) and an R65C02 data sheet.

The price is £17.25, incl VAT & p&p. Further information is available on (01) 979 2204. END

```
LIST
   10 REM ADDING 65C02 OP-CODES TO THE
          BBC ASSEMBLER
   20 REM PROGRAM BY BOB WATFORD
   30 REM
   40 REM THE FIRST PART OF THE PROGRAM
          SHOWS HOW THE NEW OP-CODES
          ARE USED
   50 REM
   60 REM LINES BELOW 30000 MAY BE
          DELETED, AND REPLACED BY YOUR
          OWN CODE
   70 REM
   80 REM Z% SHOULD BE REPLACED BY THE
          VARIABLE USED FOR 'OPT'
          (eg. opt, PASS ETC)
   90 REM
  100DIM CODE% &100
  110TEST=&12:BGTEST=&ABCD
  120FORZ%=4 TO 7 STEP 3
  130O%=CODE%:P%=&1000
  140[
  150OPT Z%
  160OPT FNBRA(Z%,LABEL1)
  170OPT FNORA(Z%,TEST)
  180OPT FNAND(Z%,TEST)
  190OPT FNEOR(Z%,TEST)
  200OPT FNADC(Z%,TEST)
  210OPT FNSTA(Z%,TEST)
  220OPT FNLDA(Z%,TEST)
  230OPT FNCMP(Z%,TEST)
  240OPT FNSBC(Z%,TEST)
  250.LABEL1 OPT FNTSB(Z%,TEST)
  260OPT FNTRB(Z%,TEST)
  270OPT FNBIT(Z%,TEST)
  280OPT FNSTZ(Z%,TEST)
  290OPT FNSTZX(Z%,TEST)
  300OPT FNRMB(Z%,0,TEST)
  310OPT FNRMB(Z%,1,TEST)
  320OPT FNRMB(Z%,2,TEST)
  330OPT FNRMB(Z%,3,TEST)
  340OPT FNRMB(Z%,4,TEST)
  350OPT FNRMB(Z%,5,TEST)
  360OPT FNRMB(Z%,6,TEST)
  370OPT FNRMB(Z%,7,TEST)
  380OPT FNSMB(Z%,0,TEST)
  390OPT FNSMB(Z%,1,TEST)
  400OPT FNSMB(Z%,2,TEST)
  410OPT FNSMB(Z%,3,TEST)
  420OPT FNSMB(Z%,4,TEST)
  430OPT FNSMB(Z%,5,TEST)
  440OPT FNSMB(Z%,6,TEST)
  450OPT FNSMB(Z%,7,TEST)
  460OPT FNBITI(Z%,&AA)
  470OPT FNINCA(Z%)
  480OPT FNDECA(Z%)
  490OPT FNPHY(Z%)
  500OPT FNPLY(Z%)
  510OPT FNPHX(Z%)
  520OPT FNPLX(Z%)
  530OPT FNTSB(Z%,BGTEST)
  540OPT FNTRB(Z%,BGTEST)
  550OPT FNBIT(Z%,BGTEST)
  560OPT FNJMP(Z%,BGTEST)
  570OPT FNSTZ(Z%,BGTEST)
  580OPT FNSTZX(Z%,BGTEST)
  590OPT FNBBR(Z%,0,TEST,L2)
  600.L2 OPT FNBBR(Z%,1,TEST,L3)
  610.L3 OPT FNBBR(Z%,2,TEST,L4)
  620.L4 OPT FNBBR(Z%,3,TEST,L5)
  630.L5 OPT FNBBR(Z%,4,TEST,L6)
  640.L6 OPT FNBBR(Z%,5,TEST,L7)
  650.L7 OPT FNBBR(Z%,6,TEST,L8)
  660.L8 OPT FNBBR(Z%,7,TEST,L9)
  670.L9 OPT FNBBS(Z%,0,TEST,L10)
  680.L10 OPT FNBBS(Z%,1,TEST,L11)
  690.L11 OPT FNBBS(Z%,2,TEST,L12)
  700.L12 OPT FNBBS(Z%,3,TEST,L13)
  710.L13 OPT FNBBS(Z%,4,TEST,L14)
  720.L14 OPT FNBBS(Z%,5,TEST,L15)
  730.L15 OPT FNBBS(Z%,6,TEST,L16)
  740.L16 OPT FNBBS(Z%,7,TEST,L9)
  750]
  760NEXT
  770 REM THIS IS THE END OF
          THE TEST PROGRAM
30000REM START OF 65C02 FUNCTIONS
30001END
30002DEFFNBRA(opt%,where%)
30003[OPT opt%:BNE where%:]
30004IFopt%>3 O%?-2=&80 ELSEP%?-2=&80
30005=opt%
30006DEFFNBBS(opt%,bit%,address%,where%)
30007[OPT opt%:BNE where%:]
30008IFopt%>3 O%?-2=&8F+bit%*16:O%?0=(O%
?-1)-1:O%?-1=address%:O%=O%+1 ELSEP%?-2=
&8F+bit%*16:P%?0=(P%?-1)-1:P%?-1=address
%
30009P%=P%+1
30010=opt%
30011DEFFNBBR(opt%,bit%,address%,where%)
30012[OPT opt%:BNE where%:]
30013IFopt%>3 O%?-2=&0F+bit%*16:O%?0=(O%
?-1)-1:O%?-1=address%:O%=O%+1 ELSEP%?-2=
&0F+bit%*16:P%?0=(P%?-1)-1:P%?-1=address
%
30014P%=P%+1
30015=opt%
30016DEFFNPHY(opt%)
30017[OPT opt%:EQUB &5A:]
30018=opt%
30019DEFFNPLY(opt%)
30020[OPT opt%:EQUB &7A:]
30021=opt%
30022DEFFNPHX(opt%)
30023[OPT opt%:EQUB &DA:]
30024=opt%
30025DEFFNPLX(opt%)
30026[OPT opt%:EQUB &FA:]
30027=opt%
30028DEFFNRMB(opt%,bit%,address%)
30029[OPT opt%:EQUB bit%*16+&07:EQUB add
ress%:]
30030=opt%
30031DEFFNSMB(opt%,bit%,address%)
30032[OPT opt%:EQUB bit%*16+&87:EQUB add
ress%:]
30033=opt%
30034DEFFNINCA(opt%)
30035[OPT opt%:EQUB &1A:]
30036=opt%
30037DEFFNDECA(opt%)
30038[OPT opt%:EQUB &3A:]
30039=opt%
30040DEFFNTSB(opt%,address%)
30041IFaddress%>&FF [OPT opt%:EQUB &0C:E
QUW address%:] ELSE[OPT opt%:EQUB &04:EQ
UB address%:]
30042=opt%
30043DEFFNTRB(opt%,address%)
30044IFaddress%>&FF [OPT opt%:EQUB &1C:E
QUW address%:] ELSE[OPT opt%:EQUB &14:EQ
UB address%:]
30045=opt%
30046DEFFNSTZ(opt%,address%)
30047IFaddress%>&FF [OPT opt%:EQUB &9C:E
QUW address%:] ELSE[OPT opt%:EQUB &64:EQ
UB address%:]
30048=opt%
30049DEFFNSTZX(opt%,address%)
30050IFaddress%>&FF [OPT opt%:EQUB &9E:E
QUW address%:] ELSE[OPT opt%:EQUB &74:EQ
UB address%:]
30051=opt%
30052DEFFNORA(opt%,address%)
30053[OPT opt%:EQUB &12:EQUB address%:]
30054=opt%
30055DEFFNAND(opt%,address%)
30056[OPT opt%:EQUB &32:EQUB address%:]
30057=opt%
30058DEFFNEOR(opt%,address%)
30059[OPT opt%:EQUB &52:EQUB address%:]
30060=opt%
30061DEFFNADC(opt%,address%)
30062[OPT opt%:EQUB &72:EQUB address%:]
30063=opt%
30064DEFFNSTA(opt%,address%)
30065[OPT opt%:EQUB &92:EQUB address%:]
30066=opt%
30067DEFFNLDA(opt%,address%)
30068[OPT opt%:EQUB &B2:EQUB address%:]
30069=opt%
30070DEFFNCMP(opt%,address%)
30071[OPT opt%:EQUB &D2:EQUB address%:]
30072=opt%
30073DEFFNSBC(opt%,address%)
30074[OPT opt%:EQUB &F2:EQUB address%:]
30075=opt%
30076DEFFNJMP(opt%,address%)
30077[OPT opt%:EQUB &7C:EQUW address%:]
30078=opt%
30079DEFFNBIT(opt%,address%)
30080IFaddress%>&FF [OPT opt%:EQUB &3C:E
QUW address%:] ELSE[OPT opt%:EQUB &34:EQ
UB address%:]
30081=opt%
30082DEFFNBITI(opt%,byte%)
30083[OPT opt%:EQUB &89:EQUB byte%:]
30084=opt%
```

Fig 2 Program listing

SCREENPLAY

Once upon a time, Tony Hetherington was an ordinary home computing editor. Now, he's The Incredible Hulk, a Roman Emperor and a Wild West railroad boss, and all because of this month's wacky selection of games for the Oric 1/Atmos, Spectrum, BBC and others.

Classic Racing

Computer: Oric 1/Atmos
Supplier: Salamander Software
Price: £7.95

Salamander Software, better known for its Dragon software, has produced a classic for the Oric. It's a horse racing game for up to six players, with the computer filling any vacant positions.

The object of the game is to make the most money by the end of the season, which consists of between four and 16 meetings. There are six races at each meeting, and you must enter one of your 16 horses in each race.

At the start of the season, you have no idea whether your horses are candidates for the winners circle or the glue factory, so you should use the early meetings to try them out. At the end of the season you can field your best horses for the racing classics, culminating in the Derby.

Money is gained by winning races and betting, and as the prize money for the Derby is £90,000, the result is in doubt till the very end.

A typical game can last between five and 10 hours, but there's enough to keep the punters happy as they study the form and odds before the big races.

The graphics are good and add much to the game, especially during the races. People shouting for their horses will soon become hoarse.

Classic Racing is excellent value for money, and entertaining.

Presentation: Good
Use of graphics: A furlong ahead of the others
Addictive quality: You'll be chomping at the bit
Value for money: An excellent bet

The Incredible Hulk

Computers: Atari, Commodore 64, Spectrum, BBC and Apple
Supplier: Adventure International
Prices: Atari and Apple £19.95
Commodore 64 and Spectrum £9.95
BBC £7.95 (no graphics)

The Hulk is the first in the Questprobe adventure series, based on and starring the superhero characters from the Marvel comics.

You are the thin, bespectacled nuclear physicist Bruce Banner who, if provoked, turns into the green superhero the Hulk. You possess immense strength and muscular power, and can leap tall buildings, stop charging rhinos and even tear a copy of *PCW* in half. Your strength depends on how angry you are — at your strongest, you're almost uncontrollable.

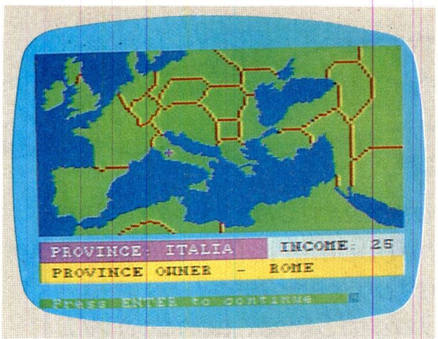
It's a typical Scott Adams adventure which features excellent graphics, but the text is written in comic book style which may deter some potential Hulks.

It's supplied with an instruction book which contains descriptions of the game's major characters, including a friendly Ant man called Hank and Ultron, a super-robot that improved its own design and has an obsessive hatred of mankind.

The game falls squarely into the problem solving group of adventures, so perhaps it's just as well that Adventure International will sell you a hint book if you're really in trouble.

I used these hints but still got stuck — this made me so angry that I . . . aagh! . . . No! . . . Not again . . .

Presentation: Good
Use of graphics: Heroic
Addictive quality: Maddening
Value for money: Good



Fall of Rome

Computers: Spectrum, BBC, Atari, Commodore 64 and Dragon
Supplier: Argus Press Software
Price: £6.99

'We do not come to bury Caesar, we come to play his game'. Not quite Shakespeare, but it sets the scene for this war game set in the fascinating period of history encompassing the decline and fall of Rome.

The might of the Empire is failing and it's under attack from marauding Huns, Vandals, Visigothians and a host of other barbarians who can be found at Stamford Bridge on any Saturday afternoon. To add to your problems as Emperor, the Eastern Empires of Armenia, Persia and Arabia have seized the opportunity to attack you. The odds are stacked against you, and it's time to rally your legions to stem the tide of tribes.

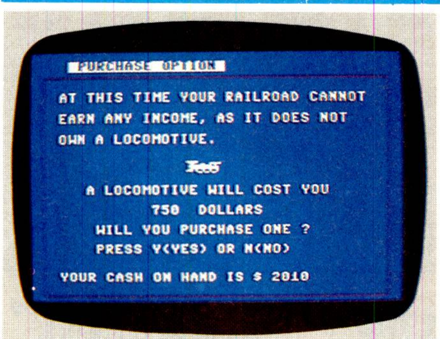
The screen display is adequate, consisting of a map of the Mediterranean provinces with a message window below it. Through this window you can raise legions, establish defences and fight tribes as you manage your limited resources.

The game is played through twelve turns, each representing five years, and you're judged on your performance. Ratings range from strategic defeat through historical result to the ultimate — a strategic victory that means the Empire will survive. I actually achieved this once but unfortunately I lost Italy, which is slightly embarrassing for a Roman Emperor.

The review copy contained one major bug — I found myself in a situation where the only possible move was an illegal one. If this happens, there is no way out except to pull the plug!

Argus only discovered the bug after making 5000 copies of the program. Anyone want to buy 5000 used tapes, cheap?

Presentation: Excellent instructions, and a map, too
Use of graphics: Adequate
Addictive quality: Bashing vandals is fun
Value for money: Excellent



Railboss

Computer: Commodore 64 + disk drive
Supplier: Commodore
Price: £11.99

If you've ever wondered why train stations seem to be in the wrong place, Railboss will be educational.

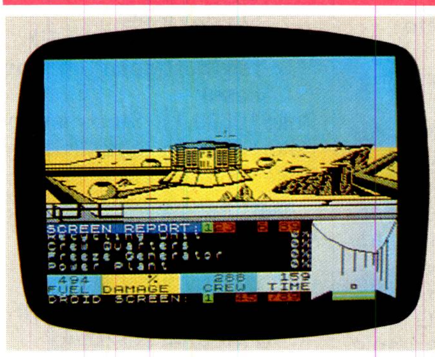
Railboss is set in the pioneering days of the Wild West, and your job is to build a railroad to Junction City. You must manage your staff, raise capital through selling shares, and cope with hazards that the wild part of the west throws at you. These include unpleasant terrain, anti-social bandits and generally unpleasant Indians. Luckily, the US cavalry are nearby but unfortunately, they always arrive just too late to help.

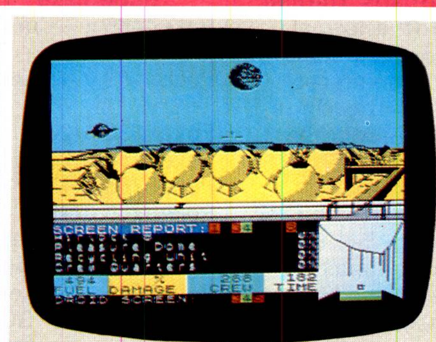
Here's an example of the type of problem you are likely to face: you have only one more mile of track to lay before building a station next to a town — very profitable, but tragically, the land hasn't been surveyed. Your surveyor isn't too keen on undertaking the work because bandits have killed his bodyguard and now they're after him.

The graphics are functional with one or two interesting touches. For example, the game's random events are presented as newspaper headlines.

The game lasts a few hours, but if you keep to the rails you'll soon become a driving force behind the railroad.

Presentation: Good
Use of graphics: Functional
Addictive quality: Diddily dum, diddly dum
Value for money: Cheaper than a day return





Psytron

Computer: 48k Spectrum
Supplier: Beyond Software
Price: £7.95

Psytron is another step in an encouraging trend away from pure arcade games towards a new breed of arcade strategy games. You'll need arcade skills, but these will be utilised as a means to a more tactical end. In other words, the days of mindlessly zapping aliens are thankfully numbered.

Here, you are the Psytron — a half-human, half-computer being whose mission is to defend the massive Beta-5 installation from attacking aliens.

You must continuallly scan the base's 10 sectors and destroy any attacking spacecraft. However, some of these attacking craft will drop saboteurs, so you must be ready to switch to droid mode to chase and destroy them before they do any damage. You must monitor damage reports, allocate repair crews, and order supplies from the orbiting supply ship.

The advertising blurb claims that this is enough to leave a human brain unhinged, and I agree. Luckily, there are a series of training levels that you must complete successfully before progressing to the next level.

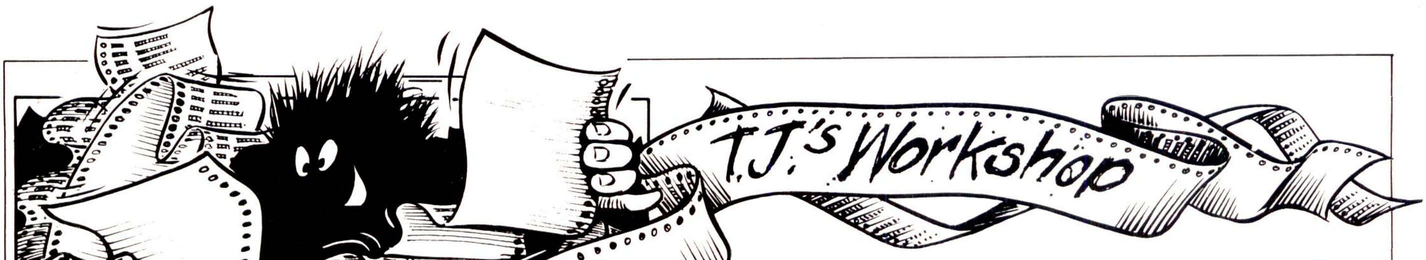
To complete a level, you must attain a pass mark in your last five attempts. This means that there are six different games, as each level is sufficiently challenging to stand on its own.

Level six is called the Final Conflict, and is the accumulation of all the game's aspects that were introduced gradually in previous levels — it's time to unhinge your brain and hang on for as long as possible. The object of the Final Conflict is to survive as long as possible, an hour being the ultimate goal.

The graphics are efficient and smooth, the action frantic as you attempt to monitor ten screens simultaneously.

A point to remember is that you are judged on your ability to restrict damage to the base, not on the number of aliens destroyed. It's pointless zapping aliens over the power plant while they're taking apart the pleasure dome.

Presentation: Good
Use of graphics: Space age
Addictive quality: Brain unhinging
Value for money: Buy it



Our monthly pot-pourri of hardware and software tips for the popular micros. If you have a favourite tip to pass on, send it to TJ's Workshop, PCW, 62 Oxford Street, London W1. Please keep your contributions concise. We will pay £5-£30 for any tips we publish. PCW can *accept no responsibility for damage caused by using these tips, and readers should be advised that any hardware modifications may render the maker's guarantee invalid.*

Commodore 64 ON ERROR routine

One of the features missing on the Commodore 64 is an ON ERROR command. The idea behind this is that when an error occurs, rather than the standard error message (for example, '?OVERFLOW ERROR IN 100') and the program halting, control is handed over to a particular line (specified by the program) which will deal with it as appropriate. This has many uses, such as suppressing invalid data messages: for example, '?REDO FROM START' and 'EXTRA IGNORED'.

How to use it

The routine at line 500 sets up the machine code, so that a simple call of 'GOSUB 500' is the only initialisation necessary.

To use this new routine, just call
545867, line number.
So, after
545867, 200
when the next error occurs, there will be a GOTO 200. This line number may be changed at any time, for the ON ERROR routine only remembers the last line given.

For example, 545867, 100
545867, 200
will GOTO 200 when an error occurs.

Great care must be taken to ensure that the specified line number does exist, and is less than 63999. This is because a call to an invalid line will itself produce an error call, resulting in an infinite loop. The only way to escape from such a condition is to press RUN STOP and restore.

The demo section of the program gives an example of error handling.

To restore the error handling back to normal, use the following:
Poke 768, 139: Poke 789, 227.

How it works

The machine code routine is split into two parts. The first is a patch into the normal error routine: this is achieved by altering the pointer at \$0300/\$0301, and forcing a 'GOTO' to the line number store at location \$00FB/\$00FC.

The second part of the routine called by '545867' actually links the patch in and gets the line number, storing it in locations \$00FB/\$00FC.

David Gristwood

```
10 REM

20 REM
40 GOSUB 500:REM  SET UP M/C ROUTINE
50 ERR=867
60 SYS ERR,200:REM  ON ERROR GOTO 200
70 A=10/0 :REM  ERROR 1
80 A=A[55]:REM  ERROR 2
100 STOP
200 PRINT"ERROR 1 IN LINE 70"
210 SYS ERR,250:REM RESET ON ERROR
230 GOTO 80
250 PRINT"ERROR 2 IN LINE 80"
260 END
279 REM
500 REM  SET UP ON ERROR M/C
520 FOR T=828 TO 889
530 :READ A:POKE T,A
540 NEXT T
560 REM  DATA FOR M/C
580 DATA 138 , 48 , 3 , 76 , 69 , 3 , 76
 , 116 , 164 , 234 , 165
600 DATA 251 , 133 , 20 , 165 , 252 , 13
3 , 21 , 76 , 163 , 168
610 DATA 234 , 0 , 0 , 0 , 0 , 0 , 0 , 3
2 , 253 , 174
620 DATA 32 , 138 , 173 , 32 , 247 , 183
 , 96 , 234 , 169 , 60
630 DATA 141 , 0 , 3 , 169 , 3 , 141 , 1
 , 3 , 32 , 88
640 DATA 3, 165 , 20 , 133 , 251 , 165 ,
 21 , 133 , 252 , 96 , 0
660 RETURN
```

Useful POKEs for Sharp MZ-80K

Poke 4464,1 — Keyboard to lower case
Poke 4464,0 — Keyboard to upper case
Poke 4465,x — Cursor to column x
Poke 4466,y — Cursor to line y
Poke 6636,0 (205)
Poke 8767,0 (218)
Poke 8768,0 (133)
Poke 8769,0 (19) — Disables Break key, ( ) enables
Poke 4685,1 — Beep on ready
Poke 7388,140
Poke 7389,25 — Allows computed GOTO: for example, (GOTO H + L)
Poke 59555,0 — Blanks screen
Poke 59555,1 — Restores screen
Poke 17828,1 — Placed after GET statement, allows computer to recognise key for as long as it is held down.
Poke 18440,0 — Changes line 1 to line 0
Poke 18440,1 — Changes line 0 to line 1
Poke 57347,5 — Turns LED green (but doesn't change case)
Poke 57347,4 — Turns LED red (but doesn't change case)
Poke 10680,1
Poke 4360,1 — Stops listing and saving
Poke 10682,1 Before 'SAVE' — auto run on LOAD
Usr (3494) — Stops POKEs snow effect
Usr(33): Usr(36) — SAVEs last NEWed program. If done after LOADing Basic, then Basic will be saved.
After bye GOTO \$1260 — Warm start
GOTO \$1200 — Cold start

Andrew McMaster

Memotech MTX screendump routine

This is a position-independent screen dump routine for a Memotech MTX computer. It is suitable for use with printers using Epson codes for producing normal density column scan bit image graphics printouts. The program works with printers from Epson, Star and Shinwa, but with

minimal changes to the codes sent in GRMODE and at the beginning to set the line feed spacing, it should also work with other dot matrix printers, such as the Seikosha range.

My own Star Gemini 10X printer takes 30 seconds to produce a screen dump.

The routine is fully relocatable. It can be loaded normally and then relocated to a suitable memory block before loading another program which will produce the image to be dumped to the printer.

There are two methods for relocating the routine: either the Move facility in PANEL, or a simple routine as shown below.

Symbols

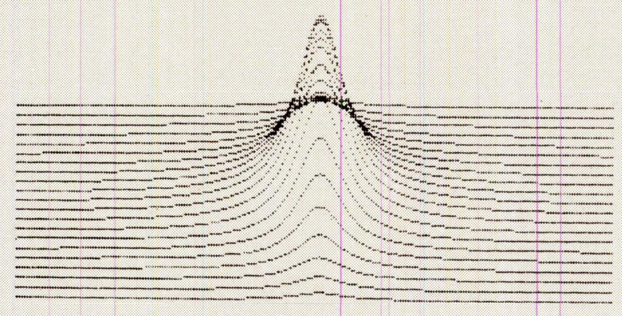
Relocation routine
4000 CODE

```
89E0    LD BC,£95      ; length of routine
89E3    LD DE,63900    ; start location of relocated routine
89E6    LD HL,£8007    ; start location of routine
89E9    LDIR
89EB    RET
```

The screen dump routine is then called by RAND USR (start address): for example, from above routine RAND USR (63900).

A Puttock

Sample screen dump



Listing of routine to produce above

```
1000 VS 4: CLS
1010 FOR X=0 TO 255
1020 FOR Y=40 TO 140 STEP 5
1030 LET Z=1/(((X-130)/125)^2+0.01)
1040 LET G=ABS(Y-40)*2.55
1050 LET R=EXP(((G-130)/125)^2+0.02)
1060 LET R=R^3
1070 LET Z=Z/R
1080 PLOT X,Y+Z
1090 NEXT : NEXT
```

Memotech MTX screen dump
by A Puttock

```
10 CODE

8007            LD A,0          ; Set up VDP to read the contents of VS 4
8009            OUT (2),A
800B            OUT (2),A
800D            DI              ; Stop any interrupts upsetting the screen dump
800E            LD B,27         ; Output ESC,A,8 to set the linefeed to 8/72 inches
8010            CALL £0CE3      ; Used to output data in B register to the printer
8013            LD B,65
8015            CALL £0CE3
8018            LD B,8
801A            CALL £0CE3
801D            LD HL,£0000     ; Zero memory locations used for character count
8020            LD (£FD9F),HL
8023            JR GRMODE       ; Set printer to column scan graphics mode
8025 LOOP:      JR GETCH        ; Read a character from the screen
8027 R1:        JR DECODE       ; Decode and print the character
8029 R2:        LD HL,(£FD9F)   ; Get character count
802C            LD A,L
802D            AND £1F         ; Is it the end of a line ?
802F            JR NZ,LOOP      ; No : Go and deal with the next character
8031            LD B,10         ; Yes : then output a line feed
8033            CALL £0CE3
8036            LD HL,(£FD9F)
8039            LD A,3
803B            CP H            ; Has the whole screen been dumped ?
803C            JR Z,END        ; Yes : then go and tidy up and return
803E GRMODE:    LD B,27         ; No : put the printer back in graphics mode for
8040            CALL £0CE3      ; another line
8043            LD B,75         ; Graphics mode is obtained by sending the following
8045            CALL £0CE3      ; ESC,K,n1,n2,...  giving a column scan of 256*n2+n1
8048            LD B,0          ; columns of one bit width
804A            CALL £0CE3
804D            LD B,1
804F            CALL £0CE3
8052            JR LOOP         ; Go back to draw the next line
8054 END:       LD B,27         ; Send ESC,@ to reinitialize the printer's conditions
8056            CALL £0CE3
8059            LD B,64
805B            CALL £0CE3
805E            EI              ; Let O.S. continue working
805F            RET             ; Return to BASIC
8060 GETCH:     LD HL,£FD97     ; Read the eight bytes representing a character into
8063            LD B,8          ; successive locations using INI, unfortunately INIR
8065            LD C,1          ; works too fast to produce reliable results
8067 INLP:      INI
8069            JR NZ,INLP
806B            JR R1
806D DECODE:    LD C,8          ; Send a character to the printer column by column
806F D1:        LD B,0
8071            LD D,8
8073 D2:        OR 0            ; Locations used by PANEL for storing tempoary
8075            DEC HL          ; register values are used to store the character
8076            RLC (HL)        ; currently being decoded and the character count
8078            JR NC,NSETB     ; this is done to allow full relocatability
807A            SET 7,B
807C NSETB:     OR 0            ; The decoding is achieved by rotating each of the
807E            DEC D           ; bytes which make up a character and setting a bit
807F            JR Z,SEND       ; in the B register if the  carry flag is set.
8081            RR B            ; The B register is also rotated and thus the column
8083            JR D2           ; scan of bits is put into the B register
8085 SEND:      CALL £0CE3      ; It is then sent to the printer
8088            LD HL,£FD9F     ; Set HL for the next column
808B            DEC C           ; Is the character finished
808C            JR NZ,D1        ; No : Go back and do next column of bits
808E            LD HL,(£FD9F)   ; Yes : increment the character count and return
8091            LD DE,£0001     ; using the JR R2 statement
8094            ADC HL,DE
8096            LD (£FD9F),HL
8099            JR R2
809B            RET

Symbols:
GRMODE  803E    GETCH     8060
LOOP    8025    DECODE    806D
R1      8027    R2        8029
END     8054    D1        806F
D2      8073    NSETB     807C
SEND    8085    INLP      8067
```

Acornsoft Forth

Missing from Acornsoft Forth for the BBC are two very useful words: CALL and USR.

Both of these prime the 6502 registers with values and execute a machine code JSR to a specified location. USR differs from CALL in that it returns a value computed from the A, X, Y and P registers when the routine ends.

Here is a screen to provide a USR function for Forth users.

Note that if you do not want any values returned on the stack from the machine code (that is, you want CALL instead of USR), omit lines 10 through 14 of the screen and insert the following at line 10: N JSR, XSAVE LDX, NEXT JMP.

Remember to load the assembler vocabulary before you compile this.

Richard Clarke

```
SCR  £60  3CH
 0   (A USR word for Acornsoft Forth)
 1   HEX CODE USR (a/x/y/addr . . . a/x/y)
 2   4C £ LDA, N STA,
 3   BOT LDA, N 1+ STA,
 4   BOT 1+ LDA, N 2+ STA,
 5   INX, INX, 0 £ LDY,
 6   BEGIN, BOT LDA, N 3 + ,Y STA,
 7   INY, INX, INX, 3 £ CPY, 0= UNTIL,
 8   XSAVE STX, N 3 + LDY,
 9   N 4 + LDX, N 5 + LDA,
10   N JSR, N 1+ STA, N 3+ STX, N 5 + STY,
11   0 £ LDA, N STA, N 2+ STA, N 4 + STA,
12   XSAVE LDX, 0 £ LDY, BEGIN, DEX,
13   N, Y LDA, 00, X STA, INY,
14   6 £ CPY, 0= UNTIL, NEXT JMP,
15   END-CODE DECIMAL
```

Dragon graphics page

A graphics page on the Dragon 32 may be saved quite simply using the CSAVEM command. On graphics, page in PMODE 4 resides between 1536 (&H0600) and 7680 (&H1E00).

Thus to save a page, set up the tape recorder, and once the graphics have been set

(do not use PCLS!) press break and type:
CSAVEM "name", 1536, 7680, 6144

The 6144 is the number of bytes between the start (1536) and the end (7680).

To get the screen back the following program can be used, which will also display it as it's being loaded:

```
10 PMODE 4: SCREEN 1,1:
   PCLS
20 CLOADM "name", 0
30 GOTO 30
```

Notes

SCREEN 1,0 may be used, if that is what was used in the drawing program.

Any graphics mode may be used, again corresponding with that used in the original program.

The zero (0) in line 20 indicates that no offset from the original start address is required.

Line 30 is to retain the graphics picture on screen, stopping the computer from returning to the text mode.

Ian Smith

Golden crypts

The idea of electronic mail and electronic postboxes, such as Telecom Gold, is excellent in theory and has many potential uses. However, it does suffer from a major defect in that it is relatively insecure. The means by which the password system can be cracked has already become public knowledge; that it can be done was vividly illustrated on a BBC Micro program, although, to be fair to British Telecom, the password used was rather obvious.

In my own work it would be very helpful to use Telecom Gold to transmit Patient Records, but on no account should they be available for unauthorised inspection, or alteration by some latter day electronic vandal. My original reaction to the articles and program was one of 'Shock! Horror!', but on reflection I realised that they were in fact performing a genuine public service because once you are aware of a problem, you can combat it.

The obvious answer is to use an encryption technique and this is extremely simple to implement on any micro. The two sample programs given here illustrate this. They are written in BBC Basic but are easily transportable to any Basic. There are four levels of encryption and the generated code is considerably more secure than that given by the Enigma or System X machines used during the 2nd World War, and would certainly defeat anyone without the expertise or technical back-up of the CIA or GCHQ. The addition of a simple check-sum routine would also give a clear indication of transmission errors or unauthorised tampering. The method also gives the ability for any department to distribute information to a number of postboxes using the same password, but ensuring that each postbox can only be decoded by the intended recipient. This would greatly simplify regular password changes.

The limitation to ASCII characters 32-122 is purely for demonstration purposes — Telecom Gold will accept and store all ASCII characters.

Don't attempt to print out the encrypted line or odd things will happen to your screen and printer.

John F Cowie

```
L.
    1REM
    2REM ENCRYPT
    3REM 3/3/84
   10MODE 3
   20ON ERROR GOTO340:REM PRESSING  ESCAPE CLOSES THE FILE AND SAVES THE ENCRYPT
ED STRING
   30PROC Password
   40CLS:PRINTTAB(10,10)"PLEASE ENTER TEXT NOW":PRINT" "
   50PROC Initialise
   60PROC Encrypt
   70END
   80DEF PROC Password
   90CLS:PRINTTAB(35,10)"PASSWORD"
  100A$=GET$:IFA$=CHR$13 THEN PROC Test ELSE P$=P$+A$:GOTO100:REM PASSWORD IS NO
T PRINTED ON THE SCREEN
  110ENDPROC
  120DEF PROC Initialise
  130P%=3:C%=0:REM P% GIVES FURTHER LEVEL OF ENCRYPTION
  140FORN=1TOLENP$:A%=ASC(MID$(P$,N,1)):P%=P%+A%:NEXT:REM CALCULATES RANDOM NUMB
ER SEED FROM PASSWORD
  150VDU2:A%=RND(-P%):A%=RND(91):REM INITIALISE THE PSEUDO RANDOM NUMBER GENERAT
OR
  160ENDPROC
  170DEF PROC Encrypt
  180REPEAT
  190 FORN=1TOLENP$
  200B%=ASC(MID$(P$,N,1))
  210P%=B% DIV 32
  220FORI=1TO P%:A%=RND(91):NEXT:REM USE PASSWORD TO FURTHER ENCRYPT DATA BY SKI
PPING SOME OF THE RANDOM NUMBER SEQUENCES
  230A$=GET$:C%=ASCA$:IFC%<32 OR C%>122 THEN 260:REM ONLY ENCRYPT ASCII TEXT
  240A%=RND(91)
  250C%=A%+C%:IFC%>122 THEN C%=C%-91:REM ADD RANDOM NUMBER TO THE ASC VALUE OF T
HE CHARACTER BUT ENSURE THAT IT STAYS IN ASCII RANGE
  260B$=CHR$C%:REM RECONVERT TO ASCII CHARACTER
  270C$=C$+B$:PRINTA$;:REM BUILD UP AN ENCRYPTED STRING AND ECHO KEYBOARD ENTRY
TO SCREEN
  280NEXT
  290UNTIL FALSE
  300ENDPROC
  310DEF PROC Test
  320IF LENP$<1 THEN CLS:PRINTTAB(10,10)"END OF PROGRAM":END:REM THIS IS A VERY
SIMPLE EXAMPLE BUT COULD BE EXPANDED
  330ENDPROC
  340PRINTC$:PRINT" ":VDU3:X=OPENOUT"CODE":PRINT£X,C$:CLOSE£X:CLS:PRINTTAB(20,6)
"END":REM THIS IS JUST A DEMONSTRATION PROGRAM
```

```
L.
    1REM
    2REM DECRYPT
    3REM 3/3/84
   10MODE 3
   20PROC Password
   30PROC Load file
   40PROC Initialise
   50PROC Decrypt
   60END
   70DEF PROC Password
   80PRINTTAB(35,10)"PASSWORD"
   90A$=GET$:IFA$=CHR$13 THEN PROC Test ELSE P$=P$+A$:GOTO90
  100ENDPROC
  110DEF PROC Initialise
  120P%=3:C%=0
  130FORN=1TOLENP$:A%=ASC(MID$(P$,N,1)):P%=P%+A%:NEXT
  140VDU2:A%=RND(-P%):A%=RND(91):REM VDU2 SENDS CHARACTERS TO PRINTER AS WELL AS
 SCREEN
  150ENDPROC
  160DEF PROC Decrypt
  170end=FALSE
  180X%=0
  190REPEAT
  200 FORN=1TOLENP$
  210B%=ASC(MID$(P$,N,1))
  220P%=B% DIV 32
  230FORI=1TO P%:A%=RND(91):NEXT
  240X%=X%+1:IFX%=LENB$ THEN N=LENP$:end=TRUE:GOTO300:REM WHEN THE STRING HAS BE
EN DECRYPTED STOP
  250C%=ASC(MID$(B$,X%,1))
  260IFC%<32 OR C%>122 THEN 290:REM NO CONTROL OR GRAPHICS CHARACTERS HAVE BEEN
ENCRYPTED
  270A%=RND(91)
  280C%=C%-A%:IFC%<32 THEN C%=C%+91
  290C$=CHR$C%:PRINTC$;
  300NEXT
  310 UNTIL end
  320 PRINT" ":PRINT" The encrypted line was "B$
  330 ENDPROC
  340DEF PROC Load file
  350X=OPENIN"CODE"
  360INPUT£X,B$:CLOSE£X
  370ENDPROC
  380DEF PROC Test
  390IF LENP$<1THENCLS:PRINTTAB(10,10)"END OF PROGRAM":END
  400ENDPROC
```

VIC-20 program merge routine

(1) Load main program from tape.
(2) Position tape at beginning of routine to be tagged on to the end of the resident Basic program.
(3) Type in immediate mode.

```
POKE 43, PEEK(45) - 2
POKE 44, PEEK(46)
LOAD
POKE 43, 1
POKE 44, 16
```

(Press RETURN after each line!)
(4) Now LIST your program, and you will find the subroutine tagged on to the end.

Note

Before merging with the main program, make sure that the version of the routine being added on has line numbers starting at a greater figure than those at the end of the main program.

A good figure to use is 60000.

Richard G Bhanap

Saving user-defined graphics on VIC-20

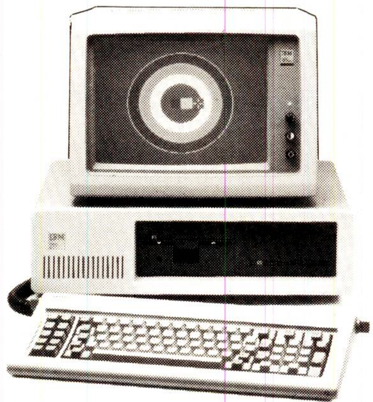
When defining characters to produce a game with defined graphics it's not necessary to run two programs every time or use up valuable program space.

The following shows how it's possible to save and load the whole defined character set along with the program using it. This is achieved by

C/WP

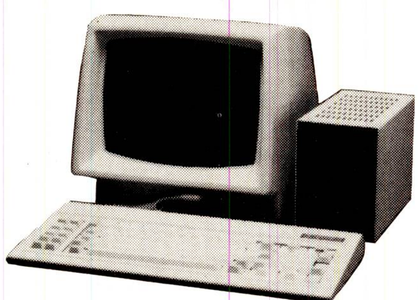
C/WP Computers
Willow House, Willow Place
London SW1P 1JH
Telephone 01-828 9000

BUSINESS SYSTEMS



IBM

C/WP supplies IBM Personal Computer systems to larger organisations and educational establishments on competitive terms. Maintenance and supply contracts are tailored to the size of the installation.



CORTEX

"The Cortex is a superb modern piece of hardware...Few compare with the Cortex on price/performance", PCN Pro-test October 1983. "It is able to plot graphs and charts much faster than conventional 8-bit machines", PCW November 1983.

APPLE

C/WP has specialised in Apple Computers for nearly four years and can offer low prices to Apple users due to in-house manufacturing of Apple peripherals.

OSBORNE

New lower prices make the Osborne a superb bargain, together with the benefits of free WordStar, Mailmerge, Supercalc and Microsoft Basic. C/WP offers engineering and software support and its own hard disk interface.

EXACT ACCOUNTING

Fully integrated business accounting system for floppy or hard disk implementation on all the above machines. Sales, purchase and nominal ledgers, invoicing, stock control and payroll, all for £512 inc. VAT.

ENGINEERING AND MAINTENANCE

C/WP's engineers are trained to component level and offer warranty and ad-hoc repairs together with on-site maintenance facilities. On-site maintenance is available at a 50% discount for the first year of ownership.

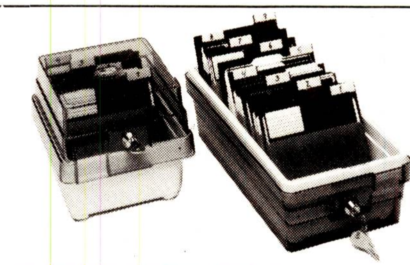
FLOPPY DISKS

Lifetime guarantee on our choice of leading brands. Boxes of 10, all certified double density. Library box **£2**

Single-sided, 40 track **£12** 80 track **£19**

Double-sided, 40 track **£19** 80 track **£21**

3½" micro disks **£39.00**



FLOPPY DISK STORAGE BOXES

A neat box with transparent lockable cover to hold up to 35 disks. With the top off the disks are presented as in a card index. A larger version will hold up to 80 disks.

Small size **£14** Large size **£19** inc VAT

LISTING PAPER

Boxes of 2000 sheets, micro-perforated fanfold. A4, 80gsm **£19**

9 inch or 14 inch **£12**

SELF ADHESIVE LABELS

All labels are **£5** per thousand.

1 across 3½" x 15/16" • 1 across 3½" x 1 7/16"
1 across 3½" x 1 15/16" • 1 across 4" x 1 7/16" • 1 across 4" x 7/16"
2 across 3½" x 15/16" • 2 across 3½" x 1 7/16"
2 across for Epson FX80 3½" x 1 7/16"
2 across for Epson FX80 3½" x 1 15/16"

Please send me details of/I enclose cheque/Access/Barclaycard (No.) ____________
____________ for £ ____________ and am ordering*
____
____
____

Name ____________
Address ____________
____________ Telephone ____________

*Delete where applicable. Prices include cash discount, VAT and 12 months guarantee.
Delivery charge £9 (£2 for small, non fragile items)

loading and protecting the characters, loading the game program, then fooling the computer into thinking it has a Basic program that fills all the memory before saving the program on tape.

When the resulting tape is loaded it loads not only the program but the characters as well.

First a character loading program (such as that shown below) is required.

```
10 POKE 51,0 : POKE 52,28 : POKE 55,0 : POKE 56,28 : CLR
20 READ A : IF A = −1 THEN END
30 POKE 7168 + X,A : X = X + 1 : GOTO 20
40 DATA 1,2,3,4,5,6,7,8,−1
```

Example

The first two POKEs in line 10 reset the bottom of strings pointer to 28 × 256, that is, 7168, and the second two POKEs reset the top of free RAM pointer to the same location. The CLR statement executes this before anything else is done. This protects the character set from being overwritten.

The rest of the program POKEs the characters into place.

This program defines only one character; in practice there would be a lot more characters. The −1 at the end of the data list ends the sequence and the program. In line 30 POKE 7168 + X,A assumes that the character pointer (location 36869) is being changed from 240 to 255 during the game to access the defined characters.

Once the loading program has run, the characters are in place and protected. It is now possible to load the game program from tape (that is, the program that will use but not define the characters) without disturbing the character set. Once the game has loaded it is necessary to add the following line at the very beginning. This is important: it must be the first line and it must be typed in exactly as shown.

```
1 POKE 45,*** : POKE 46,***
  : POKE 51,0 : POKE 52,28
  : POKE 55,0 : POKE 56,28
  : CLR
```

Do not run the program. Locations 45 & 46 point to the end of the program. This must be changed before saving and it must be set to the correct value before the program really does anything. The asterisks are length of the program; the numbers that will replace them are at present unknown. To find these numbers type:
?PEEK(45), PEEK(46)

Now replace the asterisks with these numbers. If any of the numbers has less than three digits, add a preceding zero (45 045) to maintain the length of the program.

At this point the end of program/start of numeric variables pointer must be reset to the top of user memory. Type:
POKE 45,0 : POKE 46,30

The computer now thinks that the program occupies all user memory. It doesn't care that part of this is not a Basic program.

The program can now be saved in the normal way. However, it would be just as well to verify it and if extra copies are required make them now before running the program: it will not be possible to name copies made later.

The saved tape now contains the program and the graphics and will run normally. However, if any changes are made to the program the process must be repeated.

M J Curtis

BBC 32k-16k downgrade

Attention BBC owners! If you have ever wanted to write Model A-compatible programs on your Model B but didn't feel like pulling out the RAM chips to test it, you might find this tip quite useful.

Type *FX254,1 followed by pushing the BREAK key; it has an interesting effect. This works on OS 1.2, but not with OS 0.1. The only way I have found to return to 32k is to turn off the machine.

Paul Gautrey

Sirius keyboard redefine

It seems strange to me that people in Britain know of different features than we Canadians, when the Sirius and the Victor are supposed to be the same. In any case, I would like to supply you with more of the same.

There is a very useful PRINT statement that will let you redefine any of the keys, with any single character out of the Victor's character set (Fig 1).

```
print chr$(27) + "4n" + chr$(ij) + "k"

n=1 for unshifted key        chr$(ij) = key number
n=2 for shifted key          k        = new character
n=3 for alternate key
```

Fig 1

which allows me to assign the block graphic symbols to any set of desired keys. The key will keep its new definition until re-defined again, or until the computer is cold-booted.

Finally, here are some more display features which will be of interest (Fig 2).

```
Increase brightness 'xB'
Decrease brightness 'yB'
Increase contrast 'xC'
Decrease contrast 'yC'
Clear high-intensity characters '+'
Increase audio volume 'xA'
Decrease audio volume 'yA'
Disable the keyboard '}'
Enable the keyboard '{'
Reset terminal to power on configuration 'z'
```

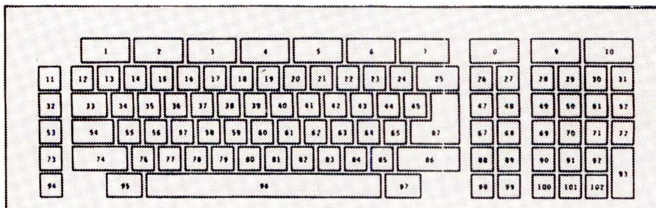
Fig 2

The diagram shows the key number legend. Note that there are no key numbers 8, 46, 66, and 75. As an example, assign the * symbol to shifted function key #1:
print chr$(27) + "42" + chr$(1) + "*"

I have found that this function will only work for characters with an ASCII code of less than 128 in Basic-86. In Turbo Pascal, all ASCII codes up to 255 work,

There are many more, mostly for word processing applications.

Ralph H Grabowski



Keyboard: entry number diagram

ANIROG
House Of Usher
ICE HUNTER
3 NEW TURBO 64 GAMES £6.95 EACH
PETCH
House of Usher
Dare you enter the House of Usher. Behind each locked door of this nine room mansion a different style of arcade action awaits you.
Petch
The wonder penguin is engaged in a desperate search for diamonds hidden in a maze of ice cubes, harassed and chased by his arch enemies Snowball and Snowbox. His chances of survival are slim. Six levels of skill with two player option.
Ice Hunter
Ice hunter needs special ice blocks to build an igloo unaffected by the arctic sun. He has found the source of the blocks in a multi level cavern, but can he outwit the grim inhabitants — the dragons — sea lions and vicious birds and float the blocks down the river to construct his dream home. Six levels and two player option.
Also available on Disk at £9.95
TRADE ENQUIRIES: ANIROG SOFTWARE LTD. 29 WEST HILL DARTFORD KENT (0322) 92513/8
MAIL ORDER: 8 HIGH STREET HORLEY SURREY 24 HOUR CREDIT CARD SALES HORLEY (02934) 6083
PAYMENT BY CHEQUE P.O. ACCESS/VISA 50p POSTAGE & PACKAGING £2.00 OVERSEAS

~CHECKOUT~

Jane vs Appleworks

The Apple II must combat stiff opposition if it's to survive, and the key to survival is software. Jerry Sanders takes an exclusive look at Apple's Appleworks and Arktronics Corporation's Jane, the latest in integrated software for the Apple II.

When Apple announced Appleworks, it became clear that a battle was on to provide a standard integrated software environment for Apple II users. The other contender is Jane, from the Arktronics Corporation. With Jane at £314 (mouse included) and Appleworks at £175, it seemed on the face of it an interesting contest.

After looking at both products I can say that there's no contest, but this isn't because one of the packages beats the other hands down: it's that the two are totally different in design, capability and user interface.

ProDOS vs DOS

An important difference is that as Jane runs under Apple DOS, it will work on any Apple II product, be it II plus, Europlus, IIe or IIc. Appleworks, on the other hand, is one of the very first applications under Apple's ProDOS operating system which the II plus and the Europlus can't cope with at the moment. ProDOS is a subset of the Apple III operating system SOS, and supports hierarchical structures for disk directories and a Pascal-style Filer for managing them. ProDOS utilities, such as creating a subdirectory or formatting a disk, are available within Appleworks from a utilities menu. Appleworks is implemented under SOS on the Apple III under the name III E-Z Pieces (pronounced 'easy pieces').

Ancient vs modern

Jane and Appleworks are combination products, each including a database spreadsheet and word processor application. In each case the three modules share a common user interface — the tools available to communicate with the programs. This is one of the most important advantages of the new integrated software products, since the sharing of command and menu structures by three or more applications gives the user the opportunity to learn all three with only one set of instructions. Both programs use the 'desktop' concept, but interpret it differently. In Appleworks, all the files you want to use have to be in RAM first — the disks are used only for storage, not as virtual memory. Switching between files is quicker this way but demands a lot of RAM. Jane uses virtual memory techniques. Although files may have a window up on the screen, the data you can't see is waiting on the disk to be called in as you scroll through the file.

The key difference, however, is in the user interface. Appleworks is menu driven, and the nearest you get to screen graphics is the depiction of sub-menus as file cards on the screen. Jane is all mice and windows, and the mouse and mouse card are both included in the price. Apple has no plans to introduce the mouse, icons or any other frippery until 1985, and quite possibly won't bother.

The question of whether mice are a gimmick or a godsend has been teasing the software industry for a while now, but a decision may soon be made. Ashton Tate's jury recently brought in a 'not mouse' verdict for its integrated package Framework, arguing that good onscreen documentation and a single interface point are the sensible solution. Apple agrees, so control key sequences are used in Appleworks and full documentation of those sequences is always available by refreshing the screen during an application.

Jane's mouse is of the single button variety which I consider to be the only kind worth having — any more and you might just as well be back at the keyboard. It also has three gears to dictate how far the screen icon moves for each twitch of the mouse on the desktop. In slow gear ('first'), the ratio is 1:1, and in fast ('third') 2:1; second (normal) lies somewhere inbetween. The higher the gear the smaller the desk area needed by the mouse, but accurate positioning is quite a skill in top gear.

'After looking at both products I can say that there's no contest, but this isn't because one of the packages beats the other hands down: it's that the two are totally different in design, capability and user interface.'

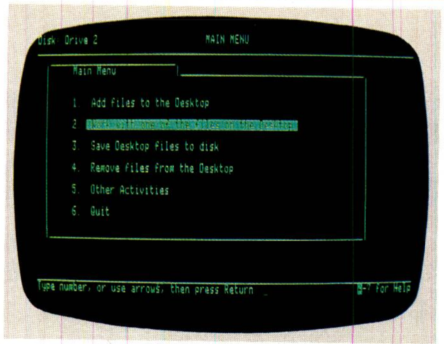
Unfortunately the icon's movement on screen is fairly jerky, and on top of that the mouse doesn't circulate too well on a shiny surface.

Both programs come on four disks. Jane boots up directly from the system disk once the mouse car has been plugged into slot four. A yellow help disk contains animated displays to demonstrate all Jane's features; when required, a screen prompt tells you to 'INSERT THE YELLOW DISK'. A third disk contains demonstration data; the fourth was originally the demo disk sent out with press releases and has now been renamed 'learning disk'. It's a rolling animated sequence — the only interaction the user gets is pressing any key to pause the 'silent movie'.

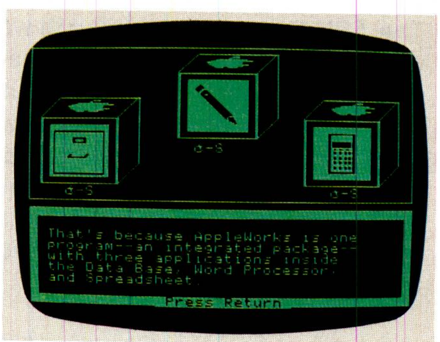
The advance copy of Appleworks supplied for this review came on four disks, the first of which is a system disk used to boot up a subset of ProDOS, including those utilities such as disk format which are available from within Appleworks. Disk two is the program disk proper, disk three demonstration data. Number four is a (double-sided) programmed training disk (PTD) and has all the graphics 'missing' from the applications!

This disk deserves a paragraph to itself. Not only are the graphics superb, but unlike Jane's so-called learning disk, the Appleworks PTD is fully interactive with question and answer tests and a helpful response to wrong answers. A disk like this from a third party would cost anything between £50 and £80.

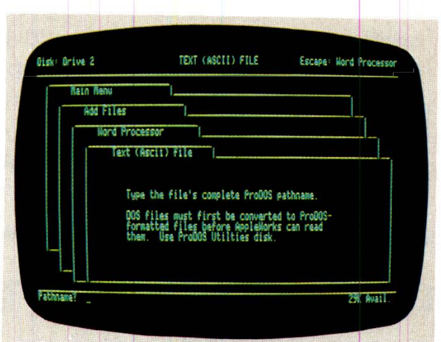
Documentation for Appleworks wasn't available at the time of this review, but the training disk was an adequate substitute in conjunction



Appleworks main menu

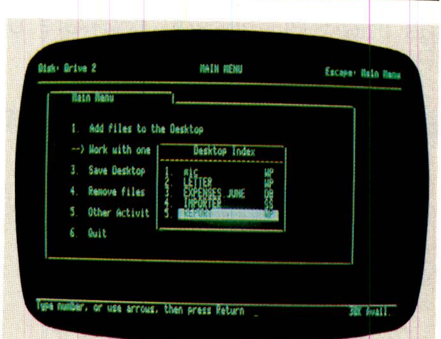


Training disk: good graphics



Layered menu structure

Spreadsheet: 999x101 cells



Your desktop at a glance

with the help screens.

To use Appleworks you need a IIe 80-column card, which adds an extra £100 if you don't already have one. On an unexpanded Apple II this leaves a minimal 10k for working files, so if you plan to make extensive use of Apple-works for large documents or data-bases the extended 80-column card at around £200 is a better bet, since this adds another 64k of RAM.

User interface

Jane boots up from one disk straight into a row of 13 icons along the top of the screen. Everything happens through the icons via the mouse, so no keyboard overlays or function keys are needed. Control key sequences are an option documented in the handbook.

Jane's icons divide into two groups. The first five icons are 'tools' and the mouse cursor becomes whichever one is active. Before you get down to work, or at any other time, an icon which looks like a computer leads to a terminal parameter menu where you select noise on/off, text size and mouse speed. From the same menu select printer driver, print quality, size and paper type (fanfold or sheet). All these commands, in common with the rest of Jane, are executed by a single click of the mouse with the cursor icon over the option required.

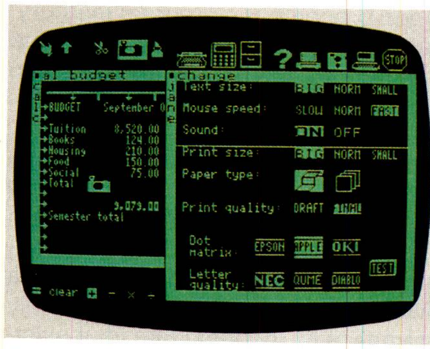
Appleworks' interface is solidly traditional. In most cases the cursor selects and the return key executes. Escape takes you out of the current menu one step backwards towards the main menu. The only concession to graphics is that all the available menu options are visible on the screen at all times as file card images so you know, for example, how many presses of the escape key will get you to the one you want.

Windows

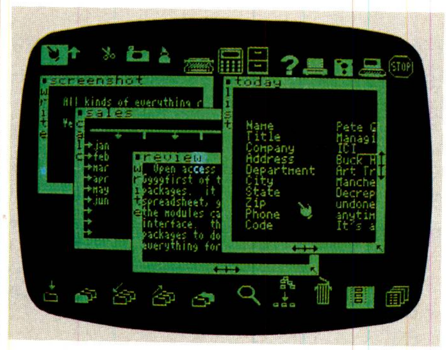
Jane wins here because Appleworks doesn't have proper windows. The one concession — a sensible one — is that a window on a spreadsheet can be opened, so the user can see two groups of cells on the screen at once from different parts of a large sheet. Jane can cope with up to four active windows at once and it manages them slowly but efficiently. Users of Microsoft Windows will no doubt find the pace snail-like and notice that window size management is unintelligent, but otherwise window management is excellent. An applications window can take on any size or shape (as long as it's four-sided). A programming bug allows the user to enlarge the window so much it obliterates the icons at the bottom of the screen.

This set of icons changes according to the application currently in use (that is, on the top of the pile), so in word processing mode (Janewrite) typeface options and formatting icons appear, to be replaced by mathematical functions in Janecalc or sort and search options in Janelist.

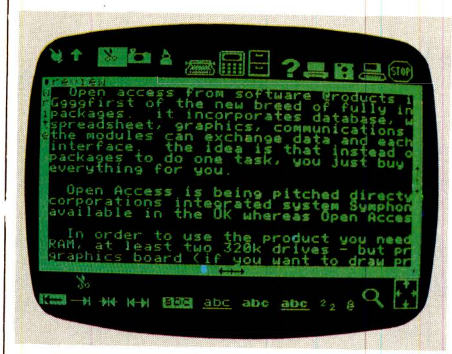
Jane: change disks for help



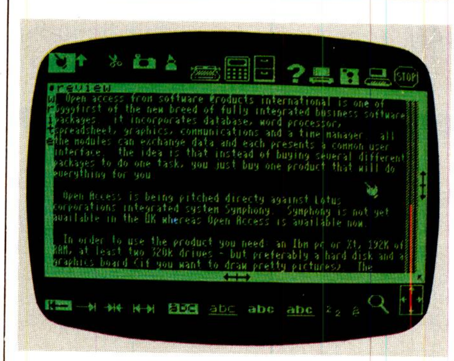
Easy options by mouse



Up to four applications windows



Word processing: large text . . .



. . . and small (with eyestrain)

Word processing

Jane's word processing screen displays three sizes of character as well as bold, sub/superscript and underline. Using the smallest text size gives a maximum 62 column by 16 row window for text entry and the likelihood of eyestrain. Large characters reduce the window to 40 × 16. At any time, block moves and copies make use of disk buffering (Appleworks uses a RAM based 'clipboard' so Jane can deal with larger blocks). Both Jane's buffer and Appleworks' clipboard contain the most recent paste-up, which can be re-used for further copying until overwritten with a new paste-up. Jane's camera icon takes a 'snapshot' of the text required, and this icon is swapped for a gluepot for sticking the text in its new location.

'Find' operates in 'instring' mode only, so if the word you want is part of a larger word you'll hit the larger word too. No global find and replace is implemented on Jane. Useful information like page, column or row number isn't provided on screen (it is in Appleworks). Automatic pagination does occur on printing. Janewrite has six printer drivers available for Epson, Apple and Oki matrix, and NEC, Qume and Diablo daisy printers.

Appleworks word processing

Janewrite puts up the typestyle on the screen, but Appleworks indicates a selection by flagging the start and finish of a block with a circumflex accent. You might forget what a particular circumflex stands for, but by putting the cursor on it the chosen parameter can be read at the bottom of the screen. With Jane, help is obtained by the user substituting a help disk for the data disk; in Appleworks, all help is immediately available on screen using the apple/question mark key combination. The same applies to the document format menu, which is clear and comprehensive despite packing in no less than 40 options (Fig 1). Here, Apple has gone one better than Microsoft, whose word processing package Word boasts flexibility of stylesheets it can't deliver (see *PCW* June). An Appleworks stylesheet is easy to set up and save on disk. To use it (for reproducing the same style of document consistently and without effort) choose the saved sheet as the active document, rename it to avoid losing the original, and type away. Simple, effective and a joy to use.

Appleworks allows up to three printer drivers to be online, and provides for Apple, Epson and Qume Sprint models (ten in all), plus an eleventh option for customising to one not named.

Integration

Apart from the advantage of using a single interface for three products, integrated packages offer the ability to include spreadsheet or database output in word processing documents. Jane's operation is more transparent than Appleworks' in this respect, since all the user does is take a snapshot from a spreadsheet window and glue it into the document. With Appleworks, the same operations are available but the user is told that what he is doing is making an ASCII copy of the block, printing it to the clipboard, and copying from the clipboard to the document. Jane probably has the right idea: drivers don't really want or need to know what's happening to the carburettor when they push in the choke. Where Appleworks scores is in being able to handle input from DIF and QuickFile files to its applications files as well as ASCII, and write out to all three formats. Jane can communicate only with itself.

'Appleworks is a serious business proposition which must compete with such heavyweights as Open Access and Framework running on 16-bit machines . . .'

	Appleworks	Jane
Page width	YES	NO
Left Margin	YES	YES
Right Margin	YES	YES
Chars per inch	YES	NO
Proportional spacing	YES	NO
Indent	YES	NO
Justify/unjustify	YES	YES
Centre	YES	YES
Paper length	YES	YES
Paper type	YES	YES
Top margin	YES	YES
Bottom margin	YES	YES
Lines per inch	YES	NO
Double/triple spacing	YES	YES
Force new page	YES	NO
Protect paragraph/group	YES	NO
Page headers/footers	YES	NO
Skip lines	YES	NO
Page number automatic	YES	YES
Pause here	YES	NO
Marker set	YES	NO
Bold/super/sub/underline	YES	YES
Force page number	YES	NO

Fig 1 Comparison of Jane & Appleworks print options

Conclusion

The limitations of Jane's word processor apply generally to its database and spreadsheet, which are both less powerful and have less flexibility than their Appleworks counterparts. When I started using Jane, I had the feeling I was using a package that was indistinguishable from the real thing. After using Appleworks, this impression was confirmed. Jane does everything the user-friendly bible commands, but so slowly it must be disqualified from serious business use. In fairness, it must be said that Jane is marketed as a beginners package and there's nothing on the market for the Apple II at the moment to compete with it. However, it's not a serious competitor to Appleworks.

Appleworks is a serious business proposition which must compete with such heavyweights as Open Access and Framework running on 16-bit machines. Any Apple II user who has been preparing to go for a 16-bit machine to get the benefits of the integrated package philosophy now has a real alternative.

The Apple II already has the most comprehensive software base around, and Appleworks is a genuinely good reason to hang on another year or so before buying a more powerful computer — a lot can happen in hardware in a year. END

SOFTWARE

PlanStar

Mike Liardet looks at MicroPro's PlanStar, a comprehensive and versatile spreadsheet aimed at businessmen, accountants and financial managers.

Micropro is one of the world's best known software producers, famous primarily for its blue ribbon word processor, WordStar. In fact, the huge success enjoyed by WordStar has eclipsed the rest of MicroPro's product line, but over the years a substantial number of other products have been added to the portfolio. Most of them are easy enough to spot in the catalogues, as they are nearly all named with the 'Star' suffix. Some of MicroPro's later products are adjuncts to WordStar, such as mailing and spelling facilities, and others like InfoStar are fairly unrelated.

Following this long succession of rather 'quiet' products, MicroPro is now hoping PlanStar will take over on the centre-stage. PlanStar is a financial modelling-cum-spreadsheet system, available for CP/M, MS-DOS and PC-DOS systems. It's not MicroPro's first foray into the world of spreadsheet systems: CalcStar has been available for some time, and while not breaking any records it has proved to be a solid and workable system. But PlanStar is far more ambitious.

A quick glance at the checklist of PlanStar's features should set any accountant's heart a-flutter: it provides multiple spreadsheets, consolidation, sensitivity, analysis, equation solving and graphing. All this is in addition to the more mundane(!) facilities, such as help screens, solid documentation, and tutorial software.

PlanStar is presented as a substantial manual with four diskettes, and is fairly daunting at first. You work your way backwards through the manual: installation instructions come at the end, preceded by tutorial material, with the less immediately needed reference material, accounting for a whole three quarters of the volume, right at the front.

Setting up working disks involves the usual ritual of operating system commands. In the PC-DOS version there are specific instructions for doing this. With four disks the entire operation has to be repeated four times. There are two reasons for the considerable volume of software in PlanStar: 1) PlanStar really is packed with a lot of features; and 2) it is implemented in compiled Microsoft Basic, which is notorious for creating large code files.

One disk contains purely tutorial software, the remaining three are for the system. These include no fewer than 15 sub-programs, five language-specific text files (only these need be changed to produce a non-English version), and eight sample models. If you have larger capacity (320k +) disks you can halve the disk count. MicroPro also guardedly advises that the system will work with most of the hard-disk variants of PC-DOS. I used PlanStar across four disks throughout the Benchtest, but this involved rather too many disk changes for my liking.

The idea of blending traditional financial modelling with the newer style of spreadsheeting is not new. I have already covered three such systems in this series: Comshare's PlannerCalc (*PCW* April 83) and Masterplanner (April 84), and Ashton-Tate's The Financial Planner (December 83). In all cases, the authors attempt to dismiss pure spreadsheet systems as 'not serious', or 'something to be outgrown'. PlanStar is no exception. The first page of the manual provocatively dismisses pure spreadsheet systems because 'a successful plan for a modern business can no longer be expressed on a single piece of paper'.

The best way to get a feel for things is to start with the tutorial disk. This is a separate system entirely, with the sole purpose of teaching the new user. It's not simply a set of 'sample models', but purpose-built software introducing all the major features of PlanStar in eight lessons.

The tutorial software contains very good ideas spoilt by some frustrating aspects to the user interface, but it should be emphasised that MicroPro is almost unique in providing any tutorial software. In spite of my reservations, I did find it more useful than no tutorial at all, which is the norm with most systems.

It's quite clear that MicroPro decided that the way to gain the attention of an indolent user is to get him typing. Many of the lessons involve transcribing material from the lessons section of the manual to the screen. I find this type of thing quite pointless, and somewhat reminiscent of the 'doing 50 lines' punishment from my schooldays.

Occasionally there are discrepancies between the manual and the screen which cause a good deal of confusion. I avoided all this bother once I discovered that the '?' key would do the typing 'automatically' and then encountered the next irritation — the screen handling is very slow.

I presume that this slowness is deliberate as the 'real' software operates more quickly, but it becomes rather frustrating, particularly when you feel that you've got the message and want to pass onto the next thing. Possibly aware of this, Micropro has included a fast automatic presentation where you type nothing but just watch. Unfortunately, this turns out to be too fast and completely unstoppable. 'Oh for the days when tutorials were on paper', I hear you say. I don't agree, but software tutorials should be adjustable to your own absorption rate and PlanStar misses the boat in this respect. Just the addition of a 'speed-up' keystroke with the normal presentation

would have improved things immensely.

The actual content of the lessons is very good, and the review questions at the end of each lesson are useful. Generally these involve questions on the correct order for placing commands, True/False problems, and multiple choice options. I found them particularly taxing, and they really did test the amount I had absorbed, while simultaneously teaching me the bits I had missed.

In short, in spite of my reservations most of my initial learning of PlanStar was achieved with the tutorial disk. With only a few minor improvements to the interaction I would wax ecstatic about it instead of griping!

In use

To get the real PlanStar running, place disk one in the current disk drive and type 'PS'. Fig 1 shows the shortest session you could possibly have while still actually doing anything. After PS you must supply a model name, PlanStar's only acknowledgement that there is a disk filing system for storing models. All further interactions with the disks are automatic and once you 'END', all changes and additions are recorded automatically.

The outcome of this mini-session is the display in Fig 2. This is built up by just four lines numbered 100 to 160 (Fig 1). The order in which you type lines is irrelevant (they are always ordered by the line-number) and one way of correcting a line is simply to retype it, overwriting the original line with that number. To confirm what you have already entered, type 'LIST'; anyone who has ever worked in Basic will find familiar ground here. The 'ROWS' line specifies that there are three rows in the model; the 'COLUMNS' line specifies the number and names of the columns in like fashion. The other two lines constitute the 'logic' of the model, showing how the Profit row and the Quarter column are to be derived.

All lines starting with a line number are noted by the system as they are typed. If no line number is present, the line is acted upon immediately: this is called an 'immediate command'. CALCULATE is an immediate command, causing a sequence of operations to be performed. CALCULATEing takes two changes of disk for the four-disk version. The syntax of the stored lines is checked, the calculation is made, and finally the display is generated. The first two rows of the spreadsheet (Sales and Costs) are undefined when CALCULATE is started, and values are requested for them accordingly. These values could have been included as part of the model by entering the following before CALCULATEing:

125 Sales = 240 260 290
130 Costs = 160 175 200

When CALCULATE is finished, PlanStar drops into a spreadsheet-like mode, with a cursor pointing at the top left-hand value (240.00 in Fig 2) of the spreadsheet. The cursor can be moved using the control and E/S/D/X keys which are arranged in a diamond on the keyboard, and each moves it in an appropriate direction. For larger models only a small area of the spreadsheet can be accommodated on the screen, and attempts to move the cursor off the edge of the screen cause a very rapid redraw, so that the destination cell can be accommodated in the new display.

There are also other keystrokes for moving several rows or columns at one time, and facilities for adjusting column width and numeric precision, but that's about all PlanStar offers on the spreadsheet front. It's really a financial planning package, albeit a very powerful one, which pays lip service to spreadsheeting. In particular, it isn't possible to dynamically modify calculations or data at the cursor position, and even if it were, the speed of recalculation (see Benchmarks) would discourage anyone from using it that way.

PlanStar models have up to six different parts: row, column and worksheet definitions, logic, and reporting/graphing instructions. All parts are entered at the keyboard using the line numbering scheme already described, but not all of them need be present. For example, the model in Fig 1 has only row and column definitions and some logic. Even though there is no reporting or graphing, the results can still be viewed because of the spreadsheet facility following CALCULATE.

Other modelling systems separate these different parts of the model into individual files, an approach I have never liked as it greatly multiplies the number of files to consider. With PlanStar, everything is held together. The only requirement is that the user maintains the parts in the right order: in other words, the logic cannot refer to a row or column if it hasn't previously been specified. This is fairly obvious, and it's quite natural to start your model with the columns and rows you are going to work with.

Rows and columns can be given short and expanded names. Short names are used within calculations, whereas expanded names can be more descriptive and are used for display and reporting. PlanStar permits a theoretical maximum of 999 worksheets to be handled in one model, although in practice you'll run out of memory or disk before you reach this limit. Nonetheless, the multiple worksheet facility works very well and is a cornerstone for the consolidation facility.

Here's a flavour of the extensive modelling facilities of PlanStar:

5000 Price = 80 90 100 GROW BY 5% sets the Price row to 80, 90, 100, 105, and thereafter increasing by 5% for as many columns as necessary.

5010 Quarter = SUM OF January TO March adds the first three columns of a year, placing the result in the Quarter column.

5020 DEFINE WORKSHEET 1(UK) 2(USA) 3(Totals) defines the different worksheets to be operated on. PlanStar's multiple worksheet literally and figuratively adds a new dimension to the model. For maximum benefit all worksheets will have very similar logic but different data. It's then very easy to sum together several worksheets and place the result in a fourth, for instance. But summation is not the only option — just about any of the normal arithmetic operations can be used. For example,

5030 WORKSHEET Totals = WORKSHEET UK * 1.51 + WORKSHEET USA could be used to consolidate US and UK figures, where each model is expressed in its own currency (and $US 1.51 = £1 Sterling).

It's possible to modify all worksheets simultaneously with one command, or to focus attention on just one, or just a small part of one. The CONSIDER command is used to do this:

5030 CONSIDER January
5040 CONSIDER WORKSHEET UK
5050 Repayment = 75% * Amount

```
PS
Project name? DEMO
100 ROWS Sales Costs Profit
120 COLUMNS January February
   March Quarter
140 Profit=Sales-Costs
160 Quarter=sum of January to
   March
CALCULATE
Sales? 240 260 290
Costs? 160 175 200
END
```

Fig 1 A short introductory session

	January	February	March	Quarter
Sales	240.00	260.00	290.00	790.00
Costs	160.00	175.00	200.00	535.00
Profit	80.00	85.00	90.00	255.00

Fig 2 The resulting model

This sequence of commands will only affect the value of January's repayment in the UK. All other repayments in the row are unaffected, as are any repayments in other countries. The global effect can be regained by using CONSIDER ALL.

In general, expressions can become very complex, but there's a natural limit imposed by line-length and by the fact that parentheses are not permitted. There's also a facility for editing lines — it isn't necessary to retype a long line from scratch. PlanStar offers an extensive range of financial functions, such as amortisation, internal rate of return, net present value, and so on, but none of the mathematical functions, such as trigonometry or statistics. This is hardly surprising: the system is unlikely to appeal to the technician and is aimed squarely at the businessman, accountant or financial manager.

Sensitivity analysis

What we have seen so far is a very comprehensive modelling system, well documented and with tutorial software, but PlanStar has even more to offer than that.

Fig 3 shows a simple sales model — a plan for the next three years — where Margins, Sales and Costs are derived from the Units and SalePrice input. But like any model of the future, we may hope it's accurate but we can't be certain. What would happen if we were forced to drop the selling price by 5%? No problem for PlanStar — just type SENSITIVITY OF Margin FOR 5% CHANGE IN SalePrice and out comes the answer (Fig 4). This gives the margins for both a 5% increase and decrease in price.

Sensitivity analysis is very much a case of 'first the good news, then the bad'. A sensitive model can show spectacular increases for a small percentage increase in input values, but just as spectacularly decreases if the input values are lowered. An insensitive model shows more conservative increases, but the decreases are more conservative too. Sensitivity analysis is therefore invaluable for exploring the stability of your business plans, given the inevitable uncertainties of the future. In spite of its use in financial modelling, it is currently a rare feature — the only other system with it that I know of is a linear programming system Caxton's Optimiser.

Goal seeking

PlanStar's goal seeking facility enables you to pose questions 'against the flow' of the logic. For example, in the sales model (Fig 3) we may wish to know what selling price is needed to achieve a margin of £10,000 for 1984. On most spreadsheet systems you would be forced to use trial and error, or even (horror of horrors!) work this out by hand. The problem is that the model has been built up with Price as an input and Margin as a calculated output, but with PlanStar you can enter FIND SalePrice GIVING Margin = 10000 IN 1984 and it produces the required result (Fig 5) of £5.50 selling price.

Like sensitivity analysis, this equation-solving capability is a rarity on a modelling system. TK!Solver (*PCW* February 84) is the only other well-known system with this feature.

Graphs

PlanStar has comprehensive graphing facilities which should operate on any computer and printer. This is because the graphs are built up from the ordinary VDU/printer characters and do not need any special hardware facilities. Of course, this means that the final presentation (Figs 6-8) is not of the highest quality and does not compare with the graphing of Lotus 1-2-3, for example.

The three graphs are all derived from the same data. The specification for plotting each of them is concise and easy to use. If certain aspects of the plot are left unspecified the system uses intelligent defaults, so it's fairly easy to get started with graphing; a plot can be precisely tailored to your requirement. For example, it's generally preferable to use as much as possible of your printer paper in the plot, as this effectively increases the resolution (and you can always take a reduction photocopy of it). PlanStar comes equipped with a variety of commands for scaling, adjusting paper dimensions, and so on, but needs to be told what to plot, of course: this is done with the SHOW command. As the examples show, more than one variable can be plotted at a time. The specification for Fig 7 included:

8000 SHOW Foreign WITH *
8010 SHOW Domestic WITH +
8020 SHOW Total with ×

All the graphing commands apply no matter which graph you intend drawing, and the only difference arises with the inclusion of the BARCHART command for Fig 7 and HISTOGRAM for Fig 8.

The Benchmark results were the most disappointing aspect of the system. Financial modelling systems have a tendency to be slower than pure spreadsheet software and PlanStar is

'The first page of the manual provocatively dismisses pure spreadsheet systems because "a successful plan for a modern business can no longer be expressed on a single piece of paper".'

	1984	1985	1986
Units	50000.00	5500.00	5600.00
SalePrice	5.00	5.00	5.00
Sales	25000.00	27500.00	28000.00
Costs	17500.00	19250.00	19600.00
Margin	7500.00	8250.00	8400.00

Fig 3 Sales model

Initial Values are			
Sale Price	5.00	5.00	5.00
and			
Margin	7500.00	8250.00	8400.00
a −5% change in			
Sale Price	4.75	4.75	4.75
results in			
Margin	6250.00	6875.00	7000.00
a 5% change in			
Sale Price	5.25	5.25	5.25
results in			
Margin	8750.00	9625.00	9800.00

Fig 4 Sensitivity of Margin for 5% change in Sale Price

Target figure: Margin=10000	
	1981
Selling price	5.50
Margin	10000.00

Fig 5 Seeking goal of 10000 margin (sales model)

no exception. There is some validity in the argument that the considerable weight of functionality slows the system down, but a major reason that, for example, Lotus 1-2-3 (*PCW* November 1983) knocks spots off it for speed is that 1-2-3 was expertly implemented in compactly coded assembler language, whereas PlanStar uses the rather sluggish and large compiled Basic with much time spent reading the disks.

A new PlanStar user will quickly learn to be very careful to check everything before doing a CALCULATE. Anything but the most trivial model takes it several minutes to work out. If you have used a spreadsheet system previously, forget the 'try it and see what happens' approach.

In fact, the Benchmarks had to be slightly modified as Planstar does not permit parentheses or work in the same way as a typical spreadsheet. However, each stage in the calculation still involved the four common arithmetic operations just once, so comparisons are still valid. The model used was:

```
1000 COLUMNS Jan Feb etc Dec Tot
2000 ROWS R1 R2 R3 etc
2050 ROWS R69 R70
3000 DEFINE WORKSHEET 1
5000 CONSIDER Jan to Dec
5010 R1=1 GROW BY 1
5020 R2=12*R1/12-1+13
5030 R3=12*R2/12-1+13
etc
5700 R70=12*R69/12-1+13
5800 CONSIDER ALL COLUMNS
6000 Tot=SUM OF Jan TO Dec
```

Note that PlanStar has no equivalent of the spreadsheet 'replicate' command and the 70 lines 5010–5700 had to be typed in by hand: consequently, I couldn't test the system to capacity. I gave up typing at 70 because that was the limit reached by Comshare's CP/M version of Masterplanner (*PCW* October 83).

Conclusion

If you are looking for a fast, easy-to-use modelling system, cross PlanStar off your list. If you are more interested in solid features and facilities, particularly consolidation and sensitivity analysis, then PlanStar takes a lot of beating. But be prepared for a big learning effort: although MicroPro has made a brave attempt with the tutorial material, there really is a lot to learn!

I concluded my review of MasterPlanner, an obvious rival to PlanStar, wishing for a decent marriage between traditional financial modelling and spreadsheet technology. Now I would say that PlanStar is the most exciting financial planner I have yet seen, but it definitely does not achieve that goal. It's a great pity that MicroPro did not apply all those years of experience with highly interactive software to this, its latest product. If it had done so, it really would have something to overshadow WordStar. END

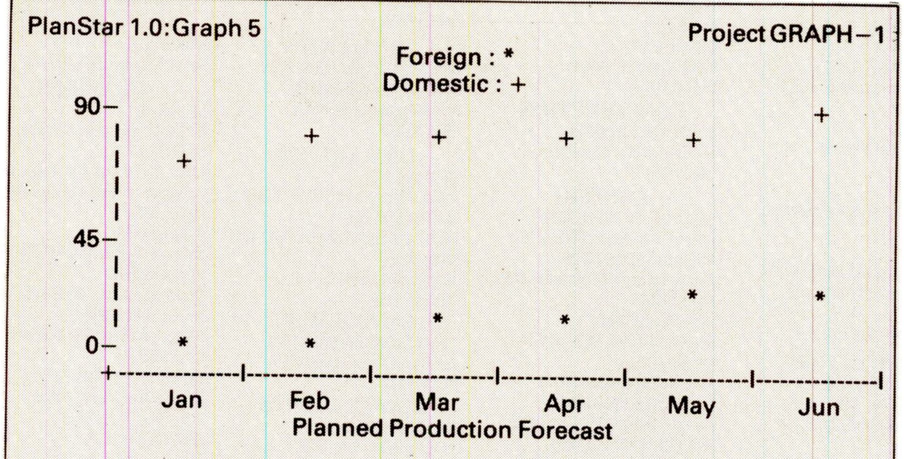


Fig 6 Point-plot graphing

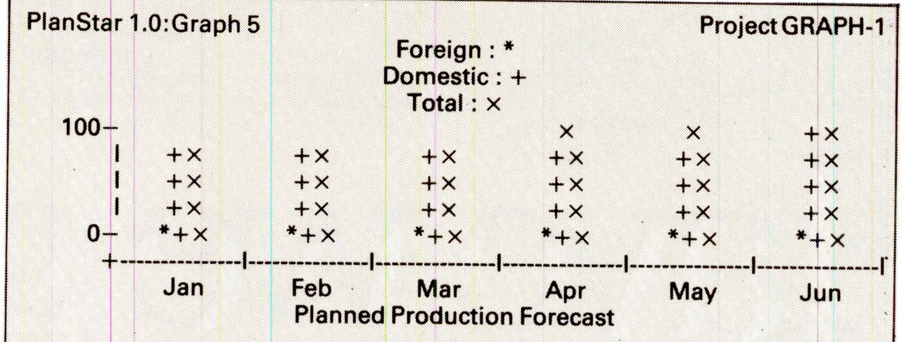


Fig 7 Bar graphing

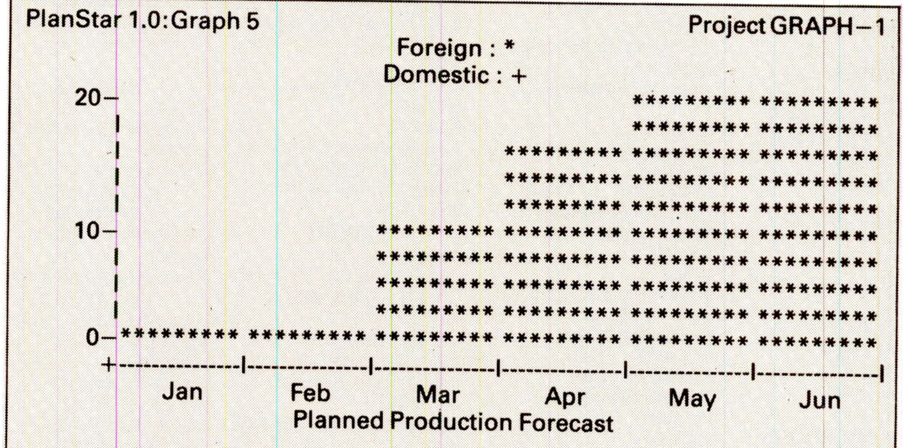


Fig 8 Histogram

Scorecard

Easy to learn:	!!(good)
Easy to use:	?(poor)
Reliability/ error handling:	!!(good)
Facilities:	!!!!(excellent)

Benchmarks

The Benchmarks were run on an IBM PC.
Spreadsheet size: 999 'worksheets' each with 32,714 entries (= rows × columns). 5000-line model.
Max column width: 70+ characters.
Benchmark 1(b) and (c) Recalculation time: 437 seconds for 70 rows (six-plus seconds per row).
1 (d) Vertical scrolling: two rows per second.
1 (e) Horizontal scrolling: 1.3 columns per second.
Benchmarks 2 and 3: Not tested.

ACCOUNTANTS
DESMET C COMPILER,
MLH Technology,
0606 891146
INCOMPLETE RECORDS,
IBIS Business Info Systems Ltd,
061-860 7123
FINAX TIMAX,
Orchard Business Systems Ltd,
0403 68461
ACCSYS,
The Data Processing Company Ltd,
0303 41618
AUDITOR,
Trionic Software Ltd, 0482 867824
WASP INCOMPLETE RECORDS SYSTEM,
Wasp Software, 01-684 7979

AGRICULTURE
FARMFAX CASH ACCOUNTS,
Farmfax Services, 0703 66123
DAISY – DAIRY INFORMATION SYSTEM,
University of Reading, 0730 875123

ARCHITECTS
DRAWINGS REGISTER SYSTEM,
Abtex Software Limited, 0274 734838
AJACS – ARCHITECTS JOB ANALYSIS,
Mercator Computer Systems Ltd,
0272 731079
ARCOS – ARCHITECTS JOB COSTING,
Insight Computer Systems Ltd,
0602 470990

SHEETPILE-2, SLIPCIRCLE-1,
Pellon Ltd,
04215 3768
QUARRYMAN,
Rural Computer Systems,
0248 353782

CONSTRUCTION
COMPUTER ESTIMATING,
The Consultancy Consortium,
04895 82103

COSTING
SALES ORDER PROCESSING,
Action File Software, 0608 41197
BUILDER'S JOB COSTING,
Aphros Software & Computers Ltd,
0843 294699
BOS/JOB COSTING,
Barcellos Limited, 0533 541574
MICROFACTS,
Facts Software, 0234 218191
EXECUTIVE JOB COSTING,
Omicron Design Ltd, 0784 31809
JOB/CONTRACT COSTING,
SMB Computer Services Limited,
0623 651651
SYSTEMATICS JOB COSTING,
Systematics Int Micro Sys Ltd,
0440 61121

DATABASE
OMNIS 1, OMNIS 3, ONMIS 2,
Blyth Computers Ltd, 050270 371
CARDBOX,
Caxton Software Ltd, 01-379 6502

MANUFACTURING DESIGN CAE,
Turnkey Comp Aided Engineering,
0272 423704

DISK UNITS
WINCHESTER DISK SUBSYSTEM,
TAPE BACKUP SUBSYSTEM,
Micro Memory Systems Ltd,
0635 40405

DRAUGHTING
DIGITMASTER,
Jentech Services Ltd, 07462 61458
MAEDOS, MAEVIS,
Micro Aided Engineering Ltd, 0842 4041
MLD, MLL,
Mountford & Laxon Co. Ltd,
021-354 5389

EMPLOYMENT
PROFESSIONAL ACCOUNTING,
A.P. Computer Consultants Ltd,
0628 22428

ESTATE AGENTS
ESTATE AGENTS,
Action File Software, 0608 41197
ASTROLABE ESTATES,
Astral & Chambers Ltd, 0279 725812
ESTAGENT,
Mimex Business Systems,
01-387 4599
HOUSEAGENT,
Spot On Software, 0934 32685
THE ESTATE AGENTS PACKAGE,
The Consultancy Consortium,
04895 82103

AIR-RAID,
R.J.L. Software Ltd, 0962 60738

GOLF
BARON GOLF,
Baron Systems, 0532 677736

GRAPHICS
DESIGN-86,
Blue Water Computer Services,
01-731 0476
GINO, TEKTRONIX 4010 EMULATION,
Carrington Computer Consultants,
01-247 8855
CHARTMAKER,
Computer Design, 01-609 1878
PRIMA-GRAPH,
Desktop Services, 02812 3854
MICRO SUPERGRAPH,
Georgetown Computer Services,
0235 817927
GENERAL PLOTTING PACKAGE,
Hydrotechnica, 0743 64939
3-D SURFACE PLOTTER,
GRAPHICS EDITOR,
Magus Computer Systems Ltd,
0225 60965
MICROCHART,
Praxis Business Systems, 0892 42267
DOODLE,
Trilex Ltd, 01-546 9670

HARDWARE
SIRIUS-80 CARD,
Small Systems Engineering Ltd,
01-328 7145

BUSY SALES INVOICING,
Midland Acc & Comp Services Ltd,
03272 71759
EXECUTIVE SALES INVOICING,
Omicron Design Ltd, 0784 31809
SALES/PRODUCT INVOICING,
Ormbeta Software, 0695 77043
PEGASUS INVOICING,
Pegasus Software Ltd, 0536 522822
SATELLITE INVOICING SYSTEM,
Satellite Software, 0622 45697
EASY ORDER ENTRY & INVOICING,
Scorpion Computing Ltd,
025126 3706
INVOICING & SALES ANALYSIS,
SMB Computer Services Limited,
0623 651651
INVOICING,
Systematics Int Micro Sys Ltd,
0440 61121

LEDGERS
INTEGRATED ACCOUNT SYSTEM,
Anagram Systems, 0403 59551
ASTROLABE LEDGERS,
Astral & Chambers Ltd, 0279 725812
EXACT ACCOUNTING,
Exact Business Systems Ltd,
0743 241371
FARMFAX MANAGEMENT ACCOUNTS,
Farmfax Services, 0730 66123
MICROLEDGERS-INTEGRATED ACCOUNTS,
Mercator Computer Systems Ltd,
0272 731079

SATELLITE NOMINAL LEDGER,
Satellite Software, 0622 45697
EASY NOMINAL LEDGER,
Scorpion Computing Ltd,
025126 3706

LEDGERS PURCHASE
EXACT PURCHASE & NOMINAL,
Exact Business Systems Ltd,
0743 241371
ISBS-F COMPANY PURCHASE SYSTEM,
Graffcom Systems Ltd, 01-385 9422
MICROLEDGERS – PURCHASE LEDGER,
Mercator Computer Systems Ltd,
0272 731079
POS-PL,
Micro Software Services,
0384 288812
BOS PURCHASE LEDGER,
MicroProducts Software Ltd,
01-831 8811
BUSY PURCHASE LEDGER,
Midland Acc & Comp Services Ltd,
03272 71759
EXECUTIVE PURCHASE LEDGER,
Omicron Design Ltd, 0784 31809
ORMBETA PURCHASE LEDGER,
Ormbeta Software, 0695 77043
PEGASUS PURCHASE LEDGER,
Pegasus Software Ltd, 0536 522822
SATELLITE PURCHASE LEDGER,
Satellite Software, 0622 45697

Have we got a p

AUCTIONEERS
AUCTION,
Mercator Computer Systems Ltd,
0272 731079

BAKERY
BAKERY ACCOUNTS,
View Data Torbay Ltd, 0626 60534

BUILDING SERVICES
HEATSOFT 1, HEATSOFT 2,
HEATSOFT 3, HEATSOFT 4,
HEATSOFT 5,
Contract Computer Software Ltd,
01-659 4444
CENTHEAT,
Dual Business Systems, 0292 281776
SPECWRITER,
Hevacomp Ltd, 0742 661003

CATERING
STORE CONTROL,
Trionic Software Limited,
0482 867824

COMMUNICATIONS
SIRIUS/MICROWRITER COMMS,
ABMS Computer Services,
0273 24953
BLAST BLOCKED ASYNCHRONOUS TRANS,
Communications Research (UK) Ltd,
0203 473015
TELE-TERM TELETYPE TERMINAL,
MCP Microsystems, 051-426 4178
TANGO-LYNK,
Network Designers Ltd, 0865 821177
DRM 29 ICL/CO3 EMULATOR,
VHA Computer Services,
0532 737475
DRM TELETYPE EMULATOR,
VHA Computer Services,
0532 732442

CONSTRUCTION
CADS 3 ANALYSE, CADS 3: PORTAL-1,
CADSSLIP, CADSFOUL, CADSPAN,
CADSTORM,
Computer & Design Services Ltd,
0202 697341
E.M.S. PINS, E.M.S. PINS, E.M.S.
FRAME 2 & FRAME 3, E.M.S. CBEAM,
Davenport Computer Systems,
021-359 0934
STRAFE 1,
H.W.D. Computing, 0272 741986
FRAME-STRUCTURAL ANALYSIS,
GRID-STRUCTURAL ANALYSIS,
SLIP CIRCLE,
Modray Ltd, 041-339 1203

DELTA, DMS+,
Compsoft Ltd, 0483 898545
THE LAST ONE,
DJ 'AI' Systems Ltd, 04605 4117
CODEWRITER,
Dynatech Microsoftware Ltd,
0481 20155
MICROFIND,
Intelligence (UK) Plc, 01-740 5758
PROGEN PLUS,
Limrose Software, 097 883 5555
BOS AUTOINDEX – CARD INDEX,
MicroProducts Software Ltd,
01-831 8811
TRENDISK/1,
Microtrend U.K., 0423 711878
AGENT, FILE 'N' FIND,
Mimex Business Systems,
01-387 4599
SENSIBLE SOLUTION,
Offshore Computing Limited,
0707 44447
BUSIFILE,
Ormbeta Software, 0695 77043
ORMBETA SOFTWARE RANGE,
Ormbeta Software, 0695 77043
OPTIMUM,
Professional Software Services,
021-445 1039
RESCUE,
Qudos Systems Ltd, 01-253 3998
NOTEBOOK,
Raven Computers, 0274 309386
TOMORROW'S OFFICE,
TOMORROW'S OFFICE JUNIOR,
TOMORROW'S OFFICE NETWORKING,
TOMORROW'S OFFICE MULTI-FILE,
SoSoft Ltd, 0202 735656
SUPERFILE,
Southdata Limited, 01-727 7564
THE ADMINISTRATOR,
Systematics Int Micro Sys Ltd,
0440 61121
KNOWLEDGE MAN,
Tamsys Ltd, 07535 56747
MDBS III,
Tamsys Ltd, 07535 56747
AQUILA EAGLE,
The Data Processing Company Ltd,
0303 41618

DESIGN
EMBIE, EMFEA, EMGEN, EMS GRILL,
Davenport Computer Systems,
021-359 0934
DESIGN DATABASE,
Hevacomp Ltd, 0742 661003

ESTIMATING
CURTAIN ESTIMATING SYSTEM,
Aylesbury Computer Systems Ltd,
0296 32591
"C.E.R.T.",
Roach Computer Services Ltd,
021-784 0880
ESTIMATER,
Trionic Software Ltd, 0482 867824
ESTIMATING AND JOB COSTING,
Turnkey Comp Aided Engineering,
0272 423704

EXPORT
ATLESS,
B & D Computing Ltd, 0793 762449

FILE TRANSFER
INTER-COMP,
MCP Microsystems, 051-426 4178
PET TO SIRIUS LINK,
Robox (Office Equipment) Ltd,
041-221 8413

FINANCIAL PLANNING
FINAL,
Datagro Ltd, 0628 20042
VIPLAN,
DMS Limited, 025 428419
EASYCALC,
Pearl Computers Ltd, 05432 22976
FINANCIAL MODELLING,
SMB Computer Services Limited,
0623 651651
SYSTEMATICS FINANCIAL PLANNING,
Systematics Int Micro Sys Ltd,
0440 61121

FIXED ASSETS
BOS FIXED ASSETS,
MicroProducts Software Ltd,
01-831 8811
FIXED ASSETS & PLANT REGISTER,
Rowan Business Services Ltd,
0482 860778
FIXED ASSETS INC. C.C.A.,
SMB Computer Services Limited,
0623 651651

FREIGHT FORWARDING
IMPEX,
Vixon Computer Systems, 0472 58561

GAMES
SOME GAMES FOR THINKERS,
Fairs Ltd, 0632 617889
ADVENTURE: ISLAND OF ARTNAN,
KM-OTHELLO, MAZE-RUNNER,
Kuma Computers Ltd, 07357 4335

HARDWARE INTERFACES
MICROCACHE, SILICON DISK,
Microcosm Research Ltd,
01-226 9092

HOTELS
HOTELIER,
Rural Computer Systems, 0248 353782
CHECK IN,
AEC Business Systems, 0732 864829

INCOMPLETE RECORDS
IRIS INCOMPLETE RECORDS SYSTEM,
Transaction Technology, 07535 56789

INSURANCE
CLASSIC POINT OF SALE UTILITY,
Adam Hunter Associates,
0993 830976
CLIENTS CALL ACCOUNT,
Fairs Ltd, 0632 617889
SILICON SALES MANAGER,
Adam Hunter Associates,
0993 830976
POLICY MASTER,
CSA Micro Systems, 0753 885389
INSURANCE MANAGER,
Fairs Ltd, 0632 617889
THE PROSPECT,
Imago Computers Ltd, 0272 213405
INSURANCE BROKERS EXECUTIVE SYSTEM,
Premium Broker Systems Ltd,
0527 46867
WASP INSURANCE BROKERS SYSTEM,
Wasp Software, 01-684 7979

INVESTMENT
FINANCIAL PORTFOLIO MANAGEMENT,
Computer Design, 01-609 1878

INVOICING
ISBS-F ORDER ENTRY AND INVOICE,
Graffcom Systems Ltd, 01-385 9422
SALESKEEPER,
Manco Softwares, 0624 832891
MICROLEDGERS INVOICING,
Mercator Computer Systems Ltd,
0272 731079
POS-IS, POS-PI,
Micro Software Services,
0384 288812
BOS INVOICING,
MicroProducts Software Ltd,
01-831 8811

PEGASUS SALES LEDGER,
Pegasus Software Ltd, 0536 522822
CASHLINK,
Rural Computer Systems,
0248 353782
SAGE PLUS, SAGE EXECUTIVE,
SAGE INTEGRATED ACCOUNTING,
Sagesoft Ltd, 0632 761669
EASY MASTER,
Scorpion Computing Ltd,
025126 3706
NOMINAL LEDGER, SALES LEDGER,
PURCHASE LEDGER & PAYMENTS,
SMB Computer Services Ltd,
0623 651651
SPOTACCOUNTS,
Spot On Software, 0934 32685
SUNACCOUNT,
Systems Union Ltd, 01-485 2594
INTEGRATED LEDGER SYSTEM,
The Consultancy Consortium,
04895 82103
BUSINESS BOOK-KEEPING 1000,
TRADER100,
Trionic Software Ltd, 0482 867824
ABBEY FILE,
View Data Torbay Ltd, 0626 60534
GENERAL LEDGER,
Systematics Int Micro Sys Ltd,
0440 61121

LEDGERS NOMINAL
ISBS-F GENERAL ACCOUNTING,
Graffcom Systems Ltd, 01-385 9422
IBIS MANAGEMENT ACCOUNTS,
IBIS Business Info Systems Ltd,
061-860 7123
MICROLEDGERS – NOMINAL LEDGER,
Mercator Computer Systems Ltd,
0272 731079
POS-GL,
Micro Software Services,
0384 288812
BOS NOMINAL LEDGER,
MicroProducts Software Ltd,
01-831 8811
BUSY NOMINAL LEDGER,
Midland Acc & Comp Services Ltd,
03272 71759
EXECUTIVE NOMINAL LEDGER,
Omicron Design Ltd, 0784 31809
ORMBETA GENERAL/NOMINAL LEDGER,
Ormbeta Software, 0695 77043
PEGASUS NOMINAL LEDGER,
Pegasus Software Ltd, 0536 522822

EASY PURCHASE LEDGER,
Scorpion Computing Ltd,
025126 3706
SYSTEMATICS PURCHASE LEDGER,
Systematics Int Micro Sys Ltd,
0440 61121

LEDGER SALES
EXACT SALES LEDGER,
Exact Business Systems Ltd,
0743 241371
ISBS-F COMPANY SALES SYSTEM,
Graffcom Systems Ltd, 01-385 9422
MICROLEDGERS – SALES LEDGER,
Mercator Computer Systems Ltd,
0272 731079
POS-SL,
Micro Software Services, 0384 28881[illegible]
BOS SALES LEDGER,
MicroProducts Software Ltd,
01-831 8811
BUSY SALES LEDGER,
Midland Acc & Comp Services Ltd,
03272 71759
EXECUTIVE SALES LEDGER,
Omicron Design Ltd, 0784 31809
SATELLITE SALES LEDGER,
Satellite Software, 0622 45697
EASY SALES LEDGER,
Scorpion Computing Ltd,
025126 3706
SYSTEMATICS SALES LEDGER,
Systematics Int Micro Sys Ltd,
0440 61121

LEGAL
SERIATIM LEGAL ACCOUNTING,
Chancery Data Ltd, 0474 814929
LAWPAK,
Solicitor Systems Ltd, 01-658 3937
SUMLAW (SOLICITORS ACCOUNTING),
Sumlock Bondain Ltd, 01-250 0505
WASP LEGAL ACCOUNTING & TIME RECORDING,
Wasp Software, 01-684 7979

MAILING
ISBS-F NAME AND ADDRESS,
Graffcom Systems Ltd, 01-385 9422
EASYMAIL,
Pearl Computers Ltd, 05432 22976
MAILMASS,
Vision Associates Ltd, 06284 75606

MANUFACTURING
TAPEMASTER,
Cambridge Numerical Control,
0480 68639

PTIM,
apricorn Computer Systems,
905 26678
AECAM,
Micro Aided Engineering Ltd,
842 4041
MANUFACTURING PARAMETERISED
CAD,
Turnkey Comp Aided Engineering,
0272 423704
PATHPLOT, PATHTRACE, PATHTURN,
Pathtrace Ltd, 03727 42444

MARKETING

PRIMA—MARKETING ANALYSIS,
Desktop Services, 02812 3854
SNAP—MARKET SURVEY ANALYSIS,
Mercator Computer Systems Ltd,
0272 731079

MEDICAL

MICROMED ENDOSCOPY,
Medical Systems Ltd, 0494 361812

MOTOR

SERVICE STATION,
Action File Software, 0608 41197
BOS M.T. VEHICLE REGISTER,
Barcellos Ltd, 0533 541574
VISITRONIC SALES & SERVICE,
Carter-Parratt Group, 01-644 4355
MIDAS MOTOR QUOTES,
Independent Systems Ltd,
0384 214993
CARRENT,
Vision Associates Ltd, 06284 75606

PERSONNEL

THE PERSONNEL ASSISTANT,
Missing Link Software, 01-349 4711

PHARMACY

DRUGMASTER,
Talkdata Ltd, 01-836 3230
PLASMA,
Vixon Computer Systems,
0472 58561

PRINTING

FANCY FONT,
PCML Limited, 0372 67282
CAXTON PRINT ESTIMATING SYSTEM,
Printers Ass Business Systems,
07535 56691
PRO-PRINT,
VHA Computer Services,
0532 732442
WASP PRINTERS COSTING SYSTEM,
Wasp Software, 01-684 7979
WASP PRINTERS ESTIMATING,
Wasp Software, 01-684 7979

PRODUCTION

BILL OF MATERIALS,
Action File Software, 0608 41197
COMAC ASSET REGISTER, COMAC CONDITION BASE, COMAC DEFECT ANALYSIS, COMAC III MAINTENANCE MANAGEMENT, COMAC PLANT HISTORY, COMAC RESOURCES, COMAC WORK IN PROGRESS,
Comac Systems plc, 0276 76118

DISKZAP-DISK UTILITY,
BusiSoft, 01-381 4337
COPYLOCK,
Export Software International,
031-556 3266
GRAPHIX, JCODE, SIRIUS/PRINTER SCREEN DUMP,
J. R. Ward Computers Ltd,
0908 562850
BOS AUTOCLERK—REPORT GENERATOR, BOS MICROCOBOL APF UTILITIES,
MicroProducts Software Ltd,
01-831 8811
BUSY REPORT GENERATOR,
Midland Acc & Comp Services Ltd,
03272 71759
MICRO-CIPHER,
MLH Technology, 0606 891146
IOSUBS,
R.J.L. Software Ltd, 0962 60738
PANEL,
Roundhill Computer Systems Ltd,
0672 54675
AUTOCODE FOR dBASE II,
Stemmos Ltd, 01-602 6242

PROGRAMMING AIDS

VUWRITER—TEXT EDITOR,
Vuman Ltd, 061-273 5315

PROGRAMMING LANGUAGE

POLYFORTH,
Computer Solutions Ltd, 09328 65292

PROPERTY

ABMS (SYZYGY) PROPERTY MANAGEMENT,
ABMS Computer Services,
0273 24953
HOUSING ASSOCIATION SYSTEM,
B & D Computing Ltd, 0793 762449
DISCOVERY ESTATE MANAGEMENT,
Mimex Business Systems,
01-387 4599

PURCHASE ORDERS

EASY PURCHASE ORDER TRACKING,
Scorpion Computing Ltd,
025126 3706
PURCHASE ORDERING,
SMB Computer Services Limited,
0623 651651

QUANTITY SURVEYOR

BOS QUANTITY SURVEYOR,
Barcellos Ltd, 0533 541574
SURVEYOR,
Computer Design, 01-609 1878

RETAIL

DATAROUND,
B & D Computing Ltd, 0793 762449
BAR STOCK CONTROL,
Trionic Software Ltd, 0482 867824
WESTERN RETAIL COUNTER,
Western Computers Ltd, 0253 404676

SALES LEDGER

ORMBETA SALES LEDGER,
Ormbeta Software,
0695 77043

ORMBETA STOCK CONTROL SYSTEM,
Ormbeta Software, 0695 77043
PEGASUS STOCK CONTROL,
Pegasus Software Ltd, 0536 522822
BARSTOCK,
Rural Computer Systems,
0248 353782
SATELLITE STOCK SYSTEM,
Satellite Software, 0622 45697
EASY STOCK CONTROL,
Scorpion Computing Ltd,
025126 3706
MBSS BAR STOCKTAKING SYSTEM,
Silicon Chip Computers Ltd,
0305 787592
SYSTEMATICS STOCK CONTROL,
Systematics Int Micro Sys Ltd,
0440 61121
STOCK CONTROL,
SMB Computer Services Ltd,
0623 651651

TECHNICAL

MICROLINK IEEE-488 PROGRAM,
Biodata Ltd,
061-236 1283
DIGITAL ANALYSIS LIBRARY,
Computer Design, 01-609 1878
AQUIFER TEST,
Hydrotechnica, 0743 64939

TELEX

MITELEX,
Interdata (Computer Systems) Ltd,
01-761 4135

TRAVEL

TRAVEL PLAN II, TRAVEL PLAN 1,
Western Computers Ltd, 0253 404676

VIDEO

VIDEO HIRE,
Action File Software, 0608 41197
VIDEOSTAR,
Aphros Software & Computers Ltd,
0843 294699
M.C. VIDEO STAR,
Georgetown Computer Services,
0235 817927

WHOLESALE

THE VINTNER,
Philcomp Systems Ltd, 02403 22339

WINDOWS

GLAZE,
Capricorn Computer Systems,
0905 26678
SEALED UNITS, WINDOWS AND DOORS,
Honeywood Computing Ltd,
0935 71117
WINDOWMAKER,
Sixteen Bit Software Ltd,
01-399 7156

WORD PROCESSING

BUSIPOST—OFFICE MANAGEMENT, SPELLBINDER,
BusiSoft, 01-381 4337
WORDCRAFT,
Dataview Wordcraft Ltd,
0206 869414

'ogram for you?

NEWSAGENTS

NEWS SHOP,
Action File Software, 0608 41197
NEWSSHOP,
Spot On Software, 0934 32685
TRIO NEWS SYSTEM,
Trio Microsystems, 0525 379229

OFFICE MANAGER

MINDER,
Pearl Computers Ltd, 05432 22976

ORDER ENTRY

ORDER ENTRY,
SMB Computer Services Ltd,
0623 651651

PAYROLL

PAYROLL SYSTEMS,
Action File Software, 0608 41197
EXACT PAYROLL,
Exact Business Systems Ltd,
0743 241371
ISBS-F PAYROLL,
Graffcom Systems Ltd, 01-385 9422
PAYROLL BUREAU SYSTEM,
IBIS Business Info Systems Ltd,
061-860 7123
BONUS,
Intex Datalog Limited, 0642 781193
BOS PAYROLL,
MicroProducts Software Ltd,
01-831 8811
BUSY COMPREHENSIVE PAYROLL,
BUSY GROSS TO NET PAYROLL,
Midland Acc & Comp Services Ltd,
03272 71759
ORMBETA PAYROLL,
Ormbeta Software,
0695 77043
PEGASUS PAYROLL,
Pegasus Software Ltd, 0536 522822
SAGE PAYROLL,
Sagesoft Ltd, 0632 761669
PAYROLL WEEKLY & MONTHLY,
SMB Computer Services Ltd,
0623 651651
SPOTPAY,
Spot On Software, 0934 32685
SYSTEMATICS PAYROLL,
Systematics Int Micro Sys Ltd,
0440 61121

PENSIONS

PENSYS86—PENSION SOFTWARE,
City of London Computer Services,
01-831 9566
THE MICRO-PENSION SYSTEM,
Micro-Pension, 01-394 2049

DEWTEC FOUNDRY PRODUCTION CONTROL,
Dewtec Computer Systems,
021-643 8003
PILOT,
Diskwise Ltd, 0752 267000
MICROSS MATERIAL CONTROL SYSTEM, MICROSS PRODUCTION CONTROL,
Kewill Systems Ltd, 0932 248328
TIMESTUDY—WORK MEASUREMENT,
Mercator Computer Systems Ltd,
0272 731079
EASY PARTS EXPLOSION,
Scorpion Computing Ltd, 025126 3706
PRODUCTION MANAGEMENT,
SMB Computer Services Limited,
0623 651651
PRODUCTION CONTROL,
Stephen Hartley Computing Ltd,
0203 24444
TEL-TIME TIME STUDY SYSTEM,
Telford Management Services,
0902 771466
TEL-SAMPLING ACTIVITY SAMPLING,
Telford Management Services,
0902 771466
MULTI-LEVEL ASSEMBLIES,
Top Business Systems Ltd,
06076 729324
PRODUCTION INTERACTIVITY MATERIAL CONTROL, PRODUCTION INTERACTIVITY PRODUCTION CONTROL, PRODUCTION SCHEDULING,
Turnkey Comp Aided Engineering,
0272 423704
Q-COST IV, STAT-PACK,
WM Management Services, 0926 28901

PROFESSIONAL

TRS—TIME RECORDING SYSTEM,
Graffcom Systems Ltd, 01-385 9422
IBIS TIME RECORDING,
IBIS Business Info Systems Ltd,
061-860 7123
MODTIME—MODULE 1,
MODTIME—MODULE 2,
MODTIME—MODULE 3,
Modray Ltd, 041-339 1203
TIME & OFFICE COSTING,
Trionic Software Ltd, 0482 867824

PROGRAMMING AIDS

ASHSCREEN,
Ashley's Computer Bureau,
0902 21941

KUMA FORTH,
Kuma Computers Ltd, 07357 4335
OPTIMISING—C86 COMPILER,
MCP Microsystems, 051-426 4178
BOS MICROCOBOL,
MicroProducts Software Ltd,
01-831 8811

PROJECTS

PLANTRAC,
Computerline Limited, 0932 55757
PERTMASTER,
Abtex Software Ltd, 0274 734838
PCC,
Hevacomp Ltd, 0742 661003
PROJECT ANAGRAM PROGRAM,
Imago Computers Ltd, 0272 213405
MICRO PLANNER,
Micro Planning Services,
0272 509417
PROJECT COST CONTROL SYSTEM,
The Consultancy Consortium,
04895 82103
PROJECTS CONTROL,
Turnkey Comp Aided Engineering,
0272 423704

STATISTICS

REGRESSION ANALYSIS,
Hydrotechnica, 0743 64939
SAM-86,
International Software, 07073 26633
STATPAK,
Raven Computers, 0274 309386

STOCK

EXACT STOCK & INVOICING,
Exact Business Systems Ltd,
0743 241371
ISBS-F STOCK CONTROL,
Graffcom Systems Ltd, 01-385 9422
STOREKEEPER,
Manco Softwares, 0624 832891
POS-SL,
Micro Software Services, 0384 288812
BOS INVENTRY CONTROL,
MicroProducts Software Ltd,
01-831 8811
BUSY STOCK & INVOICING,
Midland Acc & Comp Services Ltd,
03272 71759
EXECUTIVE STOCK CONTROL,
Omicron Design Ltd, 0784 31809

TRAINING

TOUCH 'N' GO,
Caxton Software Ltd, 01-379 6502
EASYL CITS,
Davy Computing Ltd, 0742 71201
IANKEY CRASH COURSE,
Iansyst Ltd, 01-607 5844
SNOWBALL KEYBOARD TRAINING,
MicroGuide Limited, 0602 585282
SNOWBALL WORDSTAR TRAINING TO RS,
MicroGuide Limited, 0602 585282

TRANSPORT

VEHICLE FLEET CONTROL,
Capricorn Computer Systems,
0905 26678
COACH OPERATORS,
Distinctive Systems Ltd, 0937 845735
TRANSPORT,
Halcrow Fox & Associates, 01-741 8421
AUTO-FOS CHART READER, FLEET MGMT ANALYSIS SYSTEM,
QUICK-FOS CHART READER,
Lucas Kienzle Instruments Ltd,
021-328 5533

OMAN, WP2020,
Graffcom Systems Limited,
01-385 9422
BOS AUTOWRITER,
MicroProducts Software Ltd,
01-831 8811
TRENDTEXT/2,
Microtrend U.K.,
0423 711878
PRO-FORMER, MICROTYPE, TEXTCHECKER,
MLH Technology, 0606 891146
EASYWORD,
Pearl Computers Ltd, 05432 22976
BOOK MACHINE,
Prefis Ltd,
01-904 1309
WORD PROCESSING
Systematics Int Micro Sys Ltd,
0440 61121
SILICON OFFICE,
The Bristol Software Factory,
0272 735022
BRITISH SPELLGUARD,
Vision Associates Ltd, 06284 75606

ACT

Before you buy a computer, make sure you can get the software you need.
This advertisement shows recognised software programs which can run on ACT Apricot or Sirius 16-bit business micros. For details, ring the publishers on the phone numbers listed.
For the latest packages now available, ring Freefone Apricot. There isn't a bigger published range in Britain.

Creating a program

Last month Mike Liardet, creator of Caxton's BrainStorm, gave many useful hints on the strategy to adopt when making mass-market software. He concludes his lesson this month with a thorough grounding in tactics.

Last month I looked at how you might get an idea and schedule your time accordingly. Imagine you have done this — you are sitting at the computer keyboard, you know exactly what you want to do and estimate that you're just a few months of coding away from the best computer product since Babbage's Difference Engine. Where do you go from here?

This is the moment when you have that unique opportunity, seldom available to most of us, to completely and utterly ruin a good idea. In the long run, it won't matter how smart or clever your product is: if no-one can understand how to use it, no-one will want to buy it.

Clearly, some careful thought is needed before you start coding. If you develop a good framework for the software right at the start, then everything that follows will slide easily into place and the user will find it much easier to follow.

Structured programming

A major ally for getting the overall framework correct is to adopt the structured programming technique. A great deal has already been written on this subject, much of it making far more of it than necessary. The basic idea is quite simple: you sacrifice a theoretical 2-3% of program efficiency in the interests of clarity. Instead of one monolithic program, you create lots of self-contained but inter-linking modules. These are normally arranged in a hierarchy, with the top-level module calling on lower ones, and so on, down to very primitive modules such as 'read a character'.

Once the amount of code exceeds a few pages, this is the only way you can keep track of what's happening. As a bonus, it also guarantees that your low-level code is very thoroughly tested, as it's called upon from many places and in all types of situations.

I have found it particularly useful at the preliminary stage of a project to construct (on paper or in my head) a 'world'. If you are planning an adventure game this is a fairly natural thing to do, but it might seem less obvious for an accounting system or spreadsheet.

Now an exercise that may come easily to some of you: imagine you are God. In fact, why restrict yourself? Imagine you are a *lazy* God. You have complete power of creation, destruction and direction of the world's population, but you also have an underlying purpose which you wish to achieve with minimum effort. This purpose might be to find all index cards with a particular match, perform calculations, and so on, depending on the application (or rather, depending on the 'world'). But whatever it is, you expect the world and its population to be maximally cooperative. If your world's population is lined up and you eliminate one of them, then you expect everyone else to automatically shuffle up to close the gap.

If you do this exercise for some time with different scenarios, you'll get a good feel for the operations that you want to perform on the population, and the answers you expect back.

Following this enjoyable session of megalomania, it's natural to start wondering about the form your commands and edicts will take, and also how you'll be told what's going on as a result of them. You must next design the interaction to support the dialogue needed to manipulate this world.

The original task of implementing software has now become one of implementing a world, and organising communications to and from the world. The communications medium should place as small a barrier as possible between you on the outside and the world on the inside. If you can arrange this, and the world is easily understood and well-behaved, then you are 90% of the way to a clear, ideal 'user interface'.

The output language should incorporate clear, brief, non-jargonistic, readable text. Regrettably, at least until Artificial Intelligence research delivers the goods, the input language will be more terse: you'll probably decide to direct the software through some form of menu control or command language. Using menu control is particularly attractive as it naturally imposes a structure on the underlying code, with menus branching into sub-menus, and so on. I prefer menus where selection is based on the initial letter of the option, rather than a number: the number of keystrokes are reduced and it's easier to remember which keystrokes are needed. In fact, it's a non-trivial exercise to invent 10 or more option names, each with a clear meaning but starting with a different letter of the alphabet. The latest software uses graphic icons instead of written messages, which are selected by a pointing device such as a mouse, but they can still be regarded as a menu nonetheless.

Some software operates from a command language, frequently a type of pseudo-English. The problem with command languages is that they involve a lot more typing. There are problems with mis-spellings and it's not usually certain which commands are invalid in particular situations. In

summary, they give the user every opportunity to make an error, whereas menus provide very little scope for this. Menus make things easier for the programmer too — a rare situation in software design.

The program can also be controlled by function keys. On older computers, this usually involves using the CONTROL key in conjuction with alphabetic characters. On newer systems, there is usually a range of arrow keys and numbered function keys available, enabling ordinary input and commands to be freely interleaved. For example, if you type ordinary letters into a word processor it simply echoes them onto the screen, whereas the function keys don't type anything on the screen, but move the cursor or delete words — it's possible to ruin the smoothness of interaction if you get this wrong. Microsoft's MultiPlan insists that actual data entry be preceded by a frequently forgotten function keystroke, and the program interprets what you type as a command sequence instead.

There are various useful rules for organising prompts from the program. Once a user has responded to a prompt, wipe it out — don't leave it polluting the screen to cause confusion. The easy way to do this is to write over it with the next prompt or, if there's a delay for processing, write over it with an apology for the delay.

One of the most important aspects of the user interface is the validation. Whatever key is pressed, the system must be equipped to deal with it and should never crash if the wrong type of input is given. Most programming languages supply a numeric input procedure, which can universally be relied upon *not* to do the right thing if the user enters letters or other rubbish. This means that you must write your own input validation software. A good approach is the 'dead key' technique — any illegal keys are quietly ignored. You may decide that a 'beep' is called for, but this can be irritating to the user or his colleagues if he's in a crowded office. If the input must be in upper case, don't wait for the user to type a line before telling him — do the case conversion for him as he types.

General design

The basic requirement for the software is that it's easy to learn, easy to use, and robust and reliable for a (hopefully) huge range of users. The one key fact to bear in mind is that software serves the user, not the other way round, so when coding always imagine yourself in the driving seat and try to make things as easy as possible for the driver.

Be on the lookout for any inconsistencies in jargon or interactive techniques. They are easily introduced but equally easily corrected. For example, decide on one key (ESCAPE, for example) as a quick exit keystroke and stick to it throughout. New users frequently make an incorrect choice of operation, and if they know that this one key will always 'unselect' for them it makes things easy. (This implies that the keystroke is permanently available, no matter what is happening. All too often, software forces you through a series of irrelevant questions when you know that you have selected the wrong path after the first question: very frustrating.)

Another important aspect is 'reversibility'. If a user does something, can he as easily undo it? In a word processor he might have accidentally moved a block of text, but can he move it back? Some operations, by their very nature, are irreversible ('Delete all Files', for example) and should be specially prompted with an unambiguous message ('Enter 'OK' to do it').

Some activities may take longer than a split second to perform, and if this is the case a pause message, preferably with a count*down* (not a count-up) should give an appropriate indication. Very long delays, as in lengthy printouts, should be signalled with a time estimate so that the user can go to lunch. Lengthy procedures should also be interruptible and restartable, in case of paper jams.

It's worthwhile putting some effort into the program's presentation. An attractive layout may not add anything to the functionality, but will make it look much more appealing to publishers, customers, dealers, and anyone you are trying to interest in it.

A lot of recent software has a help facility, much as you always have an ESCAPE key. Unfortunately, much of this software is insensitive to the context under which help is being requested. I have mixed feelings about help screens; if the screen prompts are properly organised initially, the user should not need any further help. Imagine he is attempting to enter a number, which the software will not accept. The HELP key is pressed, and the information that only integers in the range 0 to 99 are acceptable at this point is given. This information should have been supplied in the first place!

Screen display

Most micro owners take for granted the highly-interactive screen and instantaneous responses to their commands, but this style of interaction with computers is comparatively new. For many years, interactive computing was based around the Teletype (interactive keyboard, paper output) and before that much computing was non-interactive batch processing (input from cards or paper tape with paper output).

The computing world has been slow to exploit the new medium. Some software still has that Teletype look about it, with the screen simulating a piece of paper and scrolling before your very eyes (rather like a primitive tribe who use a brand new lorry by towing it with their oxen).

Most screens today have a variety of control mechanisms which would be meaningless on a Teletype, so it's possible to clear the screen, direct characters onto it at any selected point, and select special display modes such as inverse or flashing. You should definitely use all this without too much detail, and it's not too difficult to implement, in a sufficiently general way, a means for your software to operate with any number of different screens with little or no modification.

Some highly innovative software has emerged recently, enabling software developers to implement very sophisticated screen operations. These systems (Apple's Lisa, Microsoft's Windows and Visicorp's VisiOn) provide windowing facilities, where the screen can be split with different tasks executing in each part, and all under the control of a pointer (such as a mouse). The important point to note here is that these systems took decades to develop, and there is no point in trying to compete by implementing equivalent facilities yourself. They are actually designed to be used by software developers, so it's more a case of putting them on your shopping list if you want to arrange software interaction in this fashion.

'Most software, at some stage, requires the use of peripherals, such as disk drives or printers.'

Keyboard

The keyboard is likely to be the major source of input for your software, although the mouse and other devices can be particularly easy to use for pointing and moving operations.

Make sure that the keyboard input is still accepted when something else is being done. You don't need to write interrupt-driven software for this (arrange that at any time): consuming activity polls the keyboard at regular intervals.

If your software is driven by function keystrokes, give some thought to the keyboard ergonomics. If control keys are to be used, arrange that most of them are keys near the CONTROL key. That way, the user will only need one hand to use them. Watch out for keystrokes with some local effect on the screen unknown by the software — at least provide the user with a redraw facility should this happen.

Most software, at some stage, requires the use of peripherals such as disk drives or printers. There are two main things to consider here: coping with user errors, and dealing with different types of hardware.

Once the software has been thor-

SOFTWARE

oughly debugged it can be assumed to be error free, but errors can still occur if, for example, the user asks it to write to disk and leaves the drive door open. For some operating systems like CP/M, this causes a major failure untrappable by your software, so there is little to be done. But most operating systems return an error condition to the program which stops attempting writes to disk, tells the user what has happened and returns to a sensible point in the interactive sequence, the point at which he can elect to try again. It's a good idea when writing files to first write to a temporary file, which can be deleted if a 'disk full' condition occurs. When the writing has been completed, a sequence of renaming can be attempted. The back-up version (if it exists) of the file can be deleted, the previously current version is renamed as a back-up, and the temporary file is renamed to the current version name.

The other major peripheral you are likely to be concerned with is the printer. Printers have all kinds of special features: some provide colour, graphics plotting, special fonts, and so on. If you want your product to be as general as possible, you'll have to ignore most of this and stick to differing paper dimensions. The user should be able to interrupt the software in the middle of printing, in case the paper is wrongly positioned or the ribbon has run out. Arrange for the space bar to suspend printing — it's the easiest key to hit in a hurry! If the operating system permits, it's a good idea to test that the printer is switched on before attempting a printout. If you don't, you risk having a very puzzled user with a 'dead' keyboard and nothing happening.

Documentation

A bug can be defined as a discrepancy between the documentation and what the system actually does. The documentation defines the system, and until it's written the product does not exist. Ideally, the documentation should contain both tutorial and reference material, although there is a growing trend for tutorial software to replace the former. Some information on package contents and start-up instructions is invaluable, particularly if placed right where you can find it as soon as you open up. Also, a reference card is invaluable for expert users and costs little to produce, and an index is worth its weight in gold!

When you do get round to documenting, make sure it's well proof-read. Don't spoil good documentation with poor quality control — spelling mistakes and references to nowhere.

If you've been using some form of structured programming techniqe, much of the software will have been tested as you wrote it. Each module should be checked as it's written, as it makes the final testing much easier.

A popular misconception is that a naive user will be the best bet for testing your software. I disagree with this. Such a user would certainly test the tutorial aspects of your software, but not the overall reliability. What you really need is an expert (he will need the documentation too).

Bugs can be corrected by changing the manual — you may add: 'If the filesize is divisible by 256, the program will crash.' This may not be a desirable feature, but it's not a bug if it's documented!

A particularly ripe area for bugs is what I term the zero-case and the infinity-case. The zero-case happens if you delete the last thing left, and the infinity-case occurs when you fill things up to capacity. This may involve entering the largest numbers possible for a calculation, or by filling the system with data. The latter may involve a lot of typing, so it's usually easier to create a huge data file with specially written software.

If you have a conscience about these things and want to have a few sleepless nights, then ask yourself if there are parts of the code that have *ever* been executed. There is probably some dark corner of the software that's used once in a blue moon. Organise a thorough test for it, and if it doesn't fall over I'll send you a fiver (well, a metaphorical fiver).

If you have several testers, don't let them get together. If they work independently the testing will be more effective. While they are at it, they might as well give you some feedback on what they think of the whole thing. Don't argue if they criticise, just note it all down. If several of them say the same thing, then you might conclude that there's some validity in the criticism.

Security & anti-piracy

Having gone to all this trouble, you will be fairly upset if someone illegally copies and sells the fruits of your labours, so you might consider preventative action before they get the chance.

The most obvious point is not to release your software in source form. If a software pirate gets his hands on your source code he can easily change a few bits, making it harder for you to prove that he has ripped you off. Unless you are writing in Basic, this is unlikely to be a problem. Another easy measure is to arrange for each individual copy of the software to have its own serial number: if pirate copies do appear, you may be able to track down the source from this.

Beyond these measures, the convenience of the user suffers. There are dongles — special purpose hardware which must be present for the software to run. They put the price of the product up and if the user has several dongled packages, the insides of his computer will look like Steptoe's scrapyard. There are also techniques for making disks 'uncopiable'. The problem is that the user cannot take back-ups to protect himself from the day when his disk wears out.

The ideal solution will come when computers are released with their own internal serial number (in ROM). Software can then be released in an uncopiable format, which is only unlocked when the serial number has been registered. Thereafter, the software can be freely copied, but will not run unless the correct serial number is present. As most computers are not serialised in this way, I mention this here in the hope that a manufacturer will take the hint and do it. But by the time that happens, software may be so cheap that no-one will be bothered about copying it.

'. . . you will be fairly upset if someone copies and sells the fruits of your labours . . .'

A final point is that it's quite often useful to arrange for a demonstration version of the software to be either given away or sold at cost price - this is usually fairly easy to achieve. The key thing is to keep as many facilities available as possible, but remove one or two essential ones like writing to files, or have greatly reduced capacities, and so on. As regards copying, the opposite is true with demonstration software. Let's face it, you want as many copies as possible to find their way around!

Conclusion

We have touched upon just some of the issues involved in the complex operation of implementing a software product for the mass market.

From the programming point of view, it's different from any other type of project, requiring very high standards of design and reliability, but it also provides an opportunity for some of the most stimulating and rewarding work.

I hope these articles have provoked some of you to have a go. END

Brun's Constant

The sum of reciprocals over the twin primes converges to a finite limit, known as Brun's Constant. Ed Rosenstiel decided to attempt the calculation on a micro, and made some interesting discoveries in the process.

> ### $25,000 Prize
> *Worldwide Computer Services is offering a $25,000 prize until 31 March 1987 to prove or disprove that there are infinitely many twin primes (the twin prime conjecture).*
>
> *Ed Rosenstiel's article illustrates how far down the road you can get with a micro today; previously the calculations shown have been done with minis and mainframes.*

One learns at school that the so-called harmonic series '1 + 1/2 + 1/3 + 1/4 + 1/5 + . . . and so on' diverges to infinity, *but so does* 1/2 + 1/3 + 1/5 + 1/7 + 1/11 + 1/13 + 1/17 . . . , that is, summing similarly but only over the primes.

Schur demonstrated this in a lecture in 1932 in Germany as follows:

Assume the contrary: that is, that the sum of the prime reciprocals converges to some limit, say, K.

Then, by a formula due to Euler, we have $1 + 1/2 + 1/3 + 1/4 + 1/5 + \ldots + 1/n < (1 + 1/p_1 + 1/p_1{}^2 + 1/p_1{}^3 + ..) * (1 + 1/p_2 + 1/p_2{}^2 + 1/p_2{}^3 + ..) * \ldots * (1 + 1/p_m + 1/p_m{}^2 + 1/p_m{}^3 + ..)$

where the p_i on the right-hand side are just the m prime factors of all numbers from 1 to n.

A little bit of simple calculus then shows that *for all n:*

$$1 + 1/2 + 1/3 + 1/4 + 1/5 + .. + 1/n < \prod_{i=1}^{m} 1/(1 - 1/p_i) < \prod_{i=1}^{m} e^{2/p_i} < \exp[2*(1/2 + 1/3 + 1/5 + 1/7 + 1/11 + 1/13 + 1/17 + \ldots \text{ to infinity})] = e^{2K}$$

by the assumption, so the RHS is finite. Thus the sum of the reciprocals of all positive integers is also finite, which is false. Hence, so was the assumption. Therefore the sum of the reciprocals of *all* the primes also diverges to infinity!

Then Schur tantalised his audience by mentioning some of the problems connected with the so-called twin primes (3,5), (5,7), (11,13), (17,19), namely:

(i) it was an unsolved problem (*and still is!*), as to whether the list of twin primes ever ends; and

(ii) in 1919 Viggo Brun (who died only recently at the age of 92) stunned the mathematical world with a proof that the sum of reciprocals not over *all* the primes, but only over the twin primes (even if their number could be shown to be infinite) converges to a finite limit which is now known as **Brun's Constant** = say, S.

This much I remembered when, as part of a computer course at Birkbeck College in Pascal, I embarked on a project to calculate Brun's limit.

Writing a program in Basic to list twin primes and to evaluate the sums of their reciprocals is not difficult. The problem is that to find all the twins there is no other way but to compute almost *all* the primes, and this is a slow business on any computer. On a Commodore PET (since the machines operating Pascal were too busy most of the time), I went up to the last pair under 3020001, (later extended to 5000001), then made a

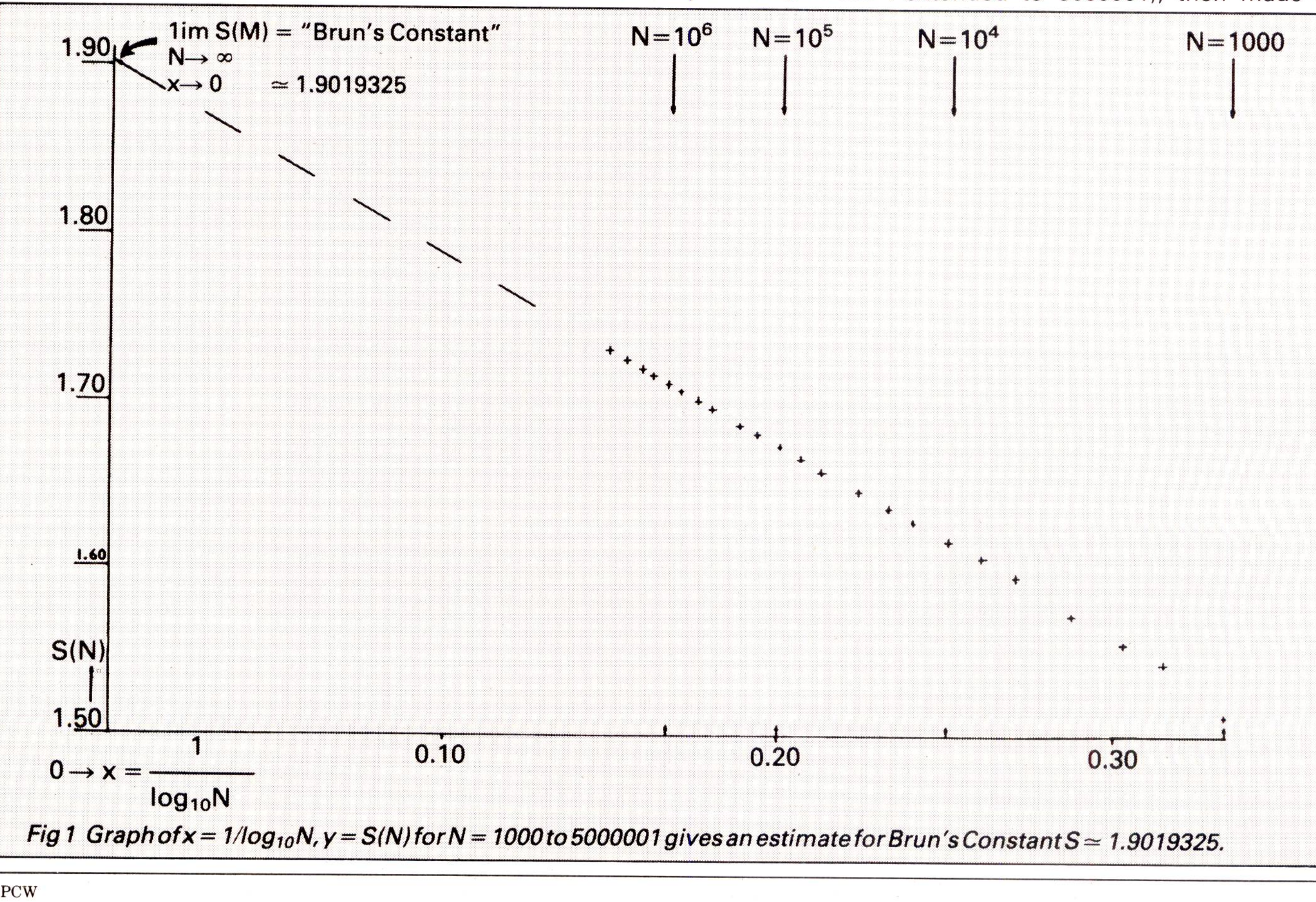


Fig 1 Graph of $x = 1/\log_{10}N$, $y = S(N)$ for N = 1000 to 5000001 gives an estimate for Brun's Constant $S \simeq 1.9019325$.

graph of necessity in logarithmic scale: that is, in powers of 10. It looked irregular at the lower end, but the gentle curve for the higher values looked promising and I also remembered that, according to Brun's Theorem, this curve would approach some horizontal line for very high values.

It seemed a good idea to eliminate the logarithmic scale, so I plotted 1/log N instead of N on the X-axis, and also left out the lower values under 10000 (Fig 1) and a *straight line* appeared.

It is remarkable in the wilderness of prime numbers, to come across an *apparently* straight line. Ignoring a professional mathematician's remark: '. . . if you take any kind of data and keep taking logs often enough, you will end up with a straight line. . .', my instinct told me this might be something original.

Using a TI-59 program which works out the least squares fit of a polynomial, I soon confirmed that I had found a much more accurate straight line than had it merely been deduced from a graph (Table 1a). And some extrapolations to values higher than those used for the least squares approximation were later found to agree with their computer counterparts to four significant digits!

Looking seriously at what was behind these findings, I decided to retrace the steps which had led me to such an extraordinary result: the 'gentle curve' prompted me to look for some closed mathematical expression to graph it and I had noticed that:

a) it was convex; and

b) it was asymptotic to a line parallel to the x-axis by Brun's Theorem, so I had thought of curves which might fit. By chance I had hit on the right answer straight away, namely on $y = S - 1/x$, the 'upside down hyperbola', although I had meant to consider also $y = S - 1/\exp(x)$ if $y = S - 1/x$ would not work.

The next step was to make a thorough literature search. Brun's Constant had indeed been calculated by several workers (3,4), and the most recent *probable* value given (4) was: $1.9021604 \pm 5 * 10^{-7}$

However, all the calculations had assumed that the famous conjecture made in 1923 by Hardy and Littlewood (6) is true. This says that the number of twin prime pairs up to some number X is closely approximated by:

$L_2(X) = 2c_2 *_2 \int^x dt/(1n\ t)^2 \sim 2c_2 X/(1n\ X)^2$

that is, neglecting terms of order $X/(1nX)^3$, where $c_2 = 0.66016181$ . . is the 'twin prime' constant as given by Brent (4).

Furthermore, Brent estimates, making the assumption that twin primes are randomly distributed with density $2c_2/(1nx)^2$, (which implies that Brun's series is an infinite series):

that $1im\ S(n) — S(X) \sim 4c_2 * x\int^{00} dt/$ $n \rightarrow \infty$

$t*(Int)^2 = 4c_2/1nX$

which is the 'Straight Line Conjecture' that I had come up with on the PET (Table 1b), with $c_2 \simeq 0.25*k*1n10 =$ 0.6596417 . . .

Does this show that, 60 years after two brilliant mathematicians had deduced a (so far unproven, but, in practice, very accurate) formula for the number of twin primes, by taking the opposite route, from the Straight Line Conjecture to the Hardy-Littlewood approximation, a mere tyro *could* have discovered this celebrated formula on a micro?

Computations

All computations were done on a Commodore PET with a simple program. These were cross-checked on a faster 'sieve' program which leaves out division by multiples of the first primes 2,3,5,7, and 11, and other checks were made against printouts of primes from a TI-59 calculator.

Most results were just copied from the VDU, but a complete printout of all twin primes less than 100000 allowed a manual count of 1224 in agreement with figures previously published by Brent (4). It was interesting to compare the calculation speed of the sieve with that of the simple program: it took the latter 25.3 days to reach the twins up to N = 1700000, while the sieve program needed only 12.2 days, a saving of ≃52%! (The sieve program took 54 days for a complete run up to N + 5000001.)

From the least squares fit (Table 1a) it will be seen that the value derived for S, on the assumption that the Straight Line Conjecture is true:

that Brun's Constant

$S = 1im\ S(N) = S(N) + k/\log N +$ error (N), $N \rightarrow \infty$

is S = 1.90074 . .

which agrees with Brent (4) for three significant digits,

while from $k = 1.1396 . . \simeq 4c_2*1n10$

we have $c_2 \simeq 0.6560$ . . .

However, there is something rather unsatisfactory in the above approach, where values below some arbitrarily chosen N are ignored for the extrapolation to S, and it is then observed that all higher values appear to lie on a straight line — not exactly, but to a high degree of 'accuracy'. (This mimics the quite different situation in physical experiments, where data is inevitably tainted due to to observational errors.) I was thus led to consider the question whether 'better' estimates for Brun's Constant might be obtainable by using a statistical approach to curve fitting.

With the help of the Applied Statistics Module for the TI-59 (7), I re-evaluated the results obtained, and also computed the correlation coefficient 'r'. Next I tried to *improve* 'r' by excluding in turn one value, arguing that because of the locally irregular distribution of primes one particular value might perhaps unduly influence the final result. As was not altogether surprising, the coefficient was improved by omitting either of the two *lowest* values for N, so I felt justified to omit both and to start calculating from N = 100001 upward, using higher values for S(N), which had come to hand. From Table 1b N = 734001 was omitted when calculating the final figures. These were: S = 1.901932526, k = 1.14591496., therefore $c_2 \simeq 0.6596417.$, where c_2 differs by 0.079%, S by 0.012% from the published results already mentioned. (The correlation coefficient was: r = 0.9999908.).

Conclusion

What I called the Straight Line Conjecture is not new, but during simple micro computations it suggested itself in a most obvious way; yet there was no hint about how to estimate *independently* the errors with these methods. If one uses the most recently published estimates for S and c_2 to calculate error terms for each N of Table 1b; that is, error (N) = $S - S(N) - 4c_2/_{1nN}$, then by a simple calculator exercise we have: $|\text{error}(N)| < 2/_N{}^{0.66}$, so k/1nN dominates the approximation.

An essential difference between Brun's and other converging series is seen when comparing it with Gregory's well-known series (which was also discovered independently by Leibniz): $\pi = 4[1 - 1/3 + 1/5 - 1/7 +- .. - 1/(2n-1)] + 1/n + \text{error}(N)$, where the error consists of terms of the form constant$/_n(2k+1)$ with $k > 0$.

Now the square-bracket expression converges to $\pi/4$ with any desired number of decimals, (although much too slowly without the correction 1/n to be of any practical use), provided that a sufficient number of terms is computed (8). To show that the same is true for Brun's series still requires proofs of conjectures of one kind or another, even if better estimates were obtained for Brun's Constant by the use of more powerful computers. It will be remembered that to determine S to only three significant figures by computing its partial sums, requires a program to 'look' at *all* prime numbers up to 10^{1000}.

Until new theories are discovered, one can still only make 'plausible' estimates, — however well these might seem to fit with computation carried out so far.

Thus the mysteries of Brun's series still beckon: only one of the many unsolved problems of The Theory of Numbers.

It is not known whether Brun's converging series S = 1/3 + 1/5 + 1/5 + 1/7 + 1/11 + 1/13 + 1/17 + 1/19 + 1/29 + 1/31 + . . . + . . has an infinite number of terms, but if so then it probably converges *very slowly* indeed with the largest error term ≃ 2.64/1nN. This has been compared with Gregory's infinite series for π which has as largest error term 1/N, thus converging too slowly for practical computation, but still much faster than Brun's series. A more well-behaved series (although a rather trivial example) is the geometric series $G = 2 = G(N) + 1/_{2^n}$ with $G(N) = (1 + 1/2 + 1/4 + 1/8 + .. + 1/_{2^n})$ where the error term is exactly $1/_{2^n}$ and convergence is correspondingly fast.

Table 1a
Plotting S(N) against $\log_{10}N$

N	$\log_{10}N$	S(N)
51	1.708	1.2700
71	1.851	1.3032
101	2.004	1.3310
151	2.179	1.3969
201	2.303	1.4286
301	2.479	1.4602
501	2.700	1.4861
701	2.846	1.5061
1001	3.000	1.5180
1501	3.176	1.5426
2001	3.300	1.5549
3001	3.477	1.5722
5001	3.699	1.5947
7001	3.845	1.6067
10001	4.000	1.6169
15001	4.176	1.6279
20001	4.301	1.6359
30001	4.477	1.6462
50001	4.699	1.6585*
70001	4.845	1.6652*
100001	5.000	1.6728*
150001	5.176	1.6806*
200001	5.301	1.6858*
350001	5.544	1.6953*
500001	5.699	1.7007*
734001	5.866	1.7064
1020001	6.009	1.7111
1142001	6.058	1.7127
1420001	6.152	1.7156
1500001	6.176	1.7164
1700001	6.230	1.7180
1800001	6.255	1.7188
2000001	6.301	1.7201
3020001	6.480	1.7251
......		

RESULTS:
From the starred values by the TI-59 pakette(2) program:

$S \simeq 1.90074..$
$k = 1.139594148$
$c_2 \simeq 0.65600..$

Table 1b
Plotting S(N) against $1/\log_{10}N$
where $S(N) = \sum [1/p + 1/(p+2)]$
$p<N$, (p and p+2 prime)

N	$1/\log_{10}N$	S(N)	least squares fit to S(N)
100001	0.1999998263	1.67279958	1.672750.
150001	0.1931958674	1.68055034	1.680546.
200001	0.1886425074	1.68584216	1.685764.
350001	0.1803729262	1.69527377	1.695240.
500001	0.1754702774	1.70071693	1.7008585
734001*	0.1704827337	1.70642789	1.706574.
1020001	0.1664281031	1.71108006	1.711220.
1142001	0.1650800688	1.71268937	1.712765.
1420001	0.1625411382	1.71564571	1.715674.
1500001	0.1619146983	1.71635648	1.716342.
1700001	0.1605020716	1.71802810	1.718011.
1800001	0.1598651315	1.71877363	1.718741.
2000001	0.1587042065	1.72013171	1.720071.
3020001	0.1543208189	1.72513665	1.725094.
5000001	0.1492766778	1.73097675	1.730874.
....			
$2*10^{10}$	0.0970776709	----------	1.7906898.
$1*10^{99}$	0.0101010101	----------	1.8903576.
....			

RESULTS:

$S \simeq 1.9019325..$ [cf. Brent (4) who gives a probable value for S as: $1.9021604 \pm 5*10^{-7}$]
$k = 1.14591496$, hence
$c_2 \simeq 0.6596417...$ and $r = 0.9999908...$

where r is the correlation coefficient computed by the TI-59 Bivariate Data Transform Program ST-12 (6).
(The starred value 734001 was not used for calculating these results,cf.p.7)

IN BOTH TABLES: $S = \lim_{N\to\infty} S(N)$

$S - S(N) \sim k/\log_{10}N$

$k \simeq 4c_2/\ln 10$ and $c_2 = 0.660161181$

[$\simeq$ is used for 'approximately equal to',
$\sim$ means 'asymptotically equal to' in the strict mathematical sense (cf.LeVeque (5)) and
c_2 is the 'twin prime constant' as given by Brent (4).]

References

1 **C L Baker and F J Gruenberger,** *Primes in the thousandth million,* P-1245, The Rand Corporation, Santa Monica, 1958
2 **J Walston,** *Least-mean-square fit of a polynomial,* Texas Instruments Inc, 1978
3 **D Shanks and J W Wrench, Jr** *Brun's Constant,* Math Comp, v28, 1974 pp293-299
4 **R P Brent,** *Irregularities in the distribution of primes and twin primes,* Math Comp, v29, 1975, pp43-56
5 **W J Leveque,** *Fundamentals of Number Theory,* p134, Addison-Wesley Publishing Company, London, 1977.
6 **G H Hardy and J E Littlewood,** *Some problems of partitio numerorum,* Acta Math, v44, 1923, pp1-70
7 **Applied Statistics,** *Solid State Software Module,* Texas Instruments Inc, 1977
8 **C W Kilmister,** *Summing infinite series,* The Gresham Lectures 1983

With thanks to the staff of Birkbeck College, Department of Mathematics.

Ed Rosenstiel came to England from Germany in the 1930s. He was a practising dentist until his retirement in 1978, when he became a maths undergraduate at Birkbeck College, London.

END

TEACH YOURSELF ASSEMBLER

Paul Overaa discusses the arithmetic operations of addition, subtraction, multiplication and division on the 6502, Z80 and 8080 processors.

This is part six of PCW's Teach Yourself Assembler series. It's unique in using Basic as its point of reference, and avoiding the 'drop you in it' approach often used on this subject. Three processors, the Z80, 6502 and 8080 are covered in detail, but enough information is provided to enable users of other processors to follow the course. Copies of earlier articles in the series, which started in February 1984, may be obtained from our Back Issues dept (see page 248).

The basic arithmetic instructions available on the 8080, Z80 and 6502 processors are for addition and subtraction. The 6502 operates on 8-bit operands only, but both the 8080 and Z80 have certain instructions that enable 16-bit operands to be dealt with.

Addition Z80

On the Z80, addition instructions take the form ADD A, operand. The specified operand is added to the value present in the accumulator, and in symbolic form we can write A ← A + operand. Various forms of addressing are possible, as follows:

ADD A,8: adds the immediate value 8 to the accumulator — that is, is performing the function A ← A + 8.

ADD A,B: adds the contents of the B register to the accumulator, thus performing the function A ← A + B.

ADD A,(HL): adds to the accumulator the contents of the byte whose address is specified by HL — that is, A ← A + (HL).

ADD A,(IX+d): in the indexed addressing form, the address of the byte to be added is found by adding a specified displacement to the address held in index register IX. The symbolic representation is A ← A + (IX+d).

Instructions for 16-bit operations use HL, IX or IY as destination registers. Typical examples are as follows:

ADD HL,DE; adds the contents of the DE pair to the contents of HL, thus performing HL ← HL+DE.

ADD IX,BC: in a similar fashion, this adds the contents of BC to the index register IX.

On the Z80, the instruction 'add with carry' (ADC) will include, in the 'addition', the carry flag value: ADC A,B will perform the function A ← A + B + Carry. The usefulness of this instruction can be seen from the example in Fig 1. We add two 'two byte numbers' — 255 and 257 — by adding the two low bytes first and then adding the two high bytes.

The addition of the low bytes causes a 'carry' to occur: the ADC instruction takes it into account when the high bytes are added. As a general rule, multibyte addition is performed by using a normal addition instruction for the first (least significant) bytes, and using the 'add with carry' instructions for succeeding bytes. The program in Fig 2 adds the contents of two 'two byte numbers' held in locations labelled FIRST$NUMBER and SECOND$NUMBER.

Because of the existence of double register addition instructions, it's possible to write a much simpler 16-bit addition program on the Z80. DE and HL can be loaded directly with the numbers to add, and an ADD HL,DE instruction used to perform the 16-bit addition with one addition instruction (Fig 3).

Addition 8080

Immediate loading of 8080 register pairs uses a LXI instruction. LXI H, SECOND$NUMBER will load the HL pair with the 16-bit address equivalent to the label SECOND$NUMBER. LDA is a direct loading of the accumulator from the byte whose address is FIRST$NUMBER. 'M' is the 8080 assembler convention to specify an indirectly addresed memory location, and it refers to the byte whose address is contained in the HL register pair. Thus, ADD M on the 8080 is performing the same function as ADD A,(HL) on the Z80. STA is the 8080 'store accumulator direct', the contents of the accumulator are stored at the address specified. INX is a 'double register increment'. After the INX H instruction, HL is pointing to the byte after that labelled SECOND$NUMBER — that is, it is pointing to SECOND$NUMBER+1. Typical 8080 code is shown in Fig 4.

An equivalent version of the second Z80 form using the HL and DE register pairs can be written, the only difference

```
 HIGH BYTES           LOW BYTES
  0000  0000           1111  1111           00FF hex = Decimal 255
  0000  0001           0000  0001           0101 hex = Decimal 257
  ----------           ----------
  0000  0010    (1)    0000  0000     ←     Result of addition
          ↑      ↑            ↑             Low byte addition causes
          |      |                          the carry to be set
          |    Carry flag
          |
High byte addition
with ADC includes
the carry value
```

Fig 1 Z80 'add with carry' instruction

```
LD     HL,SECOND$NUMBER      ;HL points to low byte of second number
LD     A,FIRST$NUMBER        ;Get low byte of first number in Acc
ADD    A,(HL)                ;Add low bytes
LD     (RESULT),A            ;Store low byte of result
LD     A,FIRST$NUMBER+1      ;Get high byte of first number
INC    HL                    ;Now points to high byte of second number
ADC    A,(HL)                ;Add high bytes + carry
LD     (RESULT+1),A          ;Store high byte of result
```

Fig 2 Z80 16-bit addition

```
LD     DE,(FIRST$NUMBER)     ;Load DE with first number
LD     HL,(SECOND$NUMBER)    ;Load HL with second number
ADD    HL,DE                 ;Performs HL ← HL + DE
LD     (RESULT),HL           ;Store result
```

Fig 3 Z80 alternative 16-bit addition

```
LXI   H,SECOND$NUMBER        ;HL points to low byte of second number
LDA   FIRST$NUMBER           ;Get low byte of first number in Acc
ADD   M                      ;Add low bytes
STA   RESULT                 ;Store low byte of result
LDA   FIRST$NUMBER+1         ;Get high byte of first number
INX   H                      ;Now points to high byte of second number
ADC   M                      ;Add high bytes + carry
STA   RESULT+1               ;Store high byte of result
```

Fig 4 8080 16-bit addition

```
LHLD  FIRST$NUMBER           ;Load HL with first number
XCHG                         ;Swap to DE
LHLD  SECOND$NUMBER          ;Load HL with second number
DAD   D                      ;Performs HL ← HL + DE
SHLD  RESULT                 ;Store result
```

Fig 5 8080 alternative 16-bit addition

```
CLC                          ;Clear carry flag
LDA   FIRST$NUMBER           ;Low byte of first number
ADC   SECOND$NUMBER          ;Add low bytes
STA   RESULT                 ;Store low byte of result
LDA   FIRST$NUMBER+1         ;High byte of first number
ADC   SECOND$NUMBER+1        ;Add high bytes
STA   RESULT+1               ;Store high byte of result
```

Fig 6 6502 16-bit addition

```
LD    HL,SECOND$NUMBER       ;HL points to low byte of second number
LD    A,FIRST$NUMBER         ;Get low byte of first number in Acc
SUB   (HL)                   ;Subtract low bytes
LD    (RESULT),A             ;Store low byte of result
LD    A,FIRST$NUMBER+1       ;Get high byte of first number
INC   HL                     ;Now points to high byte of second number
SBC   A,(HL)                 ;Subtract high bytes with borrow
LD    (RESULT+1),A           ;Store high byte of result
```

Fig 7 Z80 16-bit subtraction

```
LD    DE,(FIRST$NUMBER)      ;Load DE with first number
LD    HL,(SECOND$NUMBER)     ;Load HL with second number
AND   A                      ;Clear the carry flag
SBC   HL,DE                  ;Equivalent to HL ← HL + DE
LD    (RESULT),HL            ;Store result
```

Fig 8 Z80 alternative 16-bit subtraction

```
LXI   H,SECOND$NUMBER        ;HL Points to low byte of second number
LDA   FIRST$NUMBER           ;Get low byte of first number in Acc
SUB   M                      ;Subtract low bytes
STA   RESULT                 ;Store low byte of result
LDA   FIRST$NUMBER+1         ;Get high byte of first number
INX   H                      ;Now points to high byte of second number
SBB   M                      ;Subtract high bytes with borrow
STA   RESULT+1               ;Store high byte of result
```

Fig 9 8080 16-bit subtraction

```
SEC                          ;Set carry flag
LDA   FIRST$NUMBER           ;Low byte of first number in accumulator
SBC   SECOND$NUMBER          ;Subtract low bytes
STA   RESULT                 ;Store low byte of result
LDA   FIRST$NUMBER+1         ;High byte of first number in accumulator
SBC   SECOND$NUMBER+1        ;Subtract high bytes
STA   RESULT+1               ;Store high byte of result
```

Fig 10 6502 16-bit subtraction

being that on the 8080 it's not possible to load the DE pair directly. Instead, we load HL with the contents of the byte labelled FIRST$NUMBER, then use an exchange instruction XCHG to 'swap' the contents of the HL and DE registers. The first number is therefore placed into DE, leaving us free to re-load HL with the second number. A double register DAD D instruction is then used to perform the function HL ← HL+DE. The instruction SHLD will store the contents of the HL register pair in the two bytes RESULT and RESULT+1 (Fig 5).

Addition 6502

The only addition instruction available on the 6502 is an 'add with carry' (the mnemonic is ADC). This is no real disadvantage, but it does mean that if you wish to perform 'normal addition' you must 'clear' the carry flag before using ADC. The 6502 can be conditioned to operate in one of two modes, Binary or Decimal. The operations we are discussing are related to normal binary operation and we'll assume that the processor has been placed in binary mode by using a CLD (clear decimal mode) instruction (Fig 6).

Z80 subtraction

As with the addition instructions, it's useful to have two types of subtraction — normal subtraction and 'subtraction with borrow'. Normal subtraction (mnemonic SUB) is used for the 'low bytes' (least significant bytes), and subtraction with borrow (mnemonic SBC) is used for the succeeding bytes (most of the instructions in Fig 7 are identical to the earlier addition program). If, after the subtraction of the least significant bytes the carry flag has been set, this indicates that the value subtracted from the accumulator is greater than the accumulator value itself — a borrow has occurred. The SBC instruction allows for this 'borrow' by including the carry flag in the subtraction.

A more compact version using HL and DE can also be written. The only subtraction instruction available for the double register operations is a subtract with carry. This being so, we clear the carry flag by ANDing the accumulator with itself, thus producing a 'normal subtraction' (there is no explicit 'clear carry Z80 instruction' that could be used). The code in Fig 8 gives the general idea.

Subtraction 8080

The mnemonics are SUB and SBB. The 8080 does not have double register subtraction instructions, and the example in Fig 9 uses the accumulator as in the first 8080 addition example.

Subtraction 6502

The 'subtract with borrow' instruction on the 6502 performs the function A ← A − operand − $\overline{\text{Carry}}$, with the bar over the carry indicating the 'complement' of the carry. Borrow is thus defined as the carry flag complemented. The 6502 equivalent for a 16-bit subtraction starts by SETTING the carry flag using a SEC instruction. As with Z80 and 8080

forms, the least significant bytes are dealt with first. The equivalent 6502 program for a 16-bit subtraction is shown in Fig 10.

These ideas can be expanded to any number of bytes and the general principles remain unchanged, but for now we'll turn our attention to the slightly more complicated problem of multiplication and division.

Multiplication

Consider the base 10 product shown below:

```
  2 5     ←Multiplicand
  1 2     ←Multiplier
-------
  2 5     ←Partial products
  5 0
-------
3 0 0     ←Result
-------
```

Let's take this simple product and do the same calculation using base 2 — that is, binary arithmetic:

```
        1 1 0 0 1     ←Multiplicand
                        (25)
          1 1 0 0     ←Multiplier
                        (12)
-----------------
    1 1 0 0 1         ←Partial
                        products
      1 1 0 0 1
        0 0 0 0 0
          0 0 0 0 0
-----------------
1 0 0 1 0 1 1 0 0     ←Result (300)
-----------------
```

The important point is that the partial products are either zeros, or a 'shifted' version of the multiplicand; we can use this knowledge to devise an algorithm for binary multiplication. For each 'Bit' in the multiplier, we ask: 'Is this bit set to 1?' If it is, we add the shifted equivalent of the multiplicand to the result. Two approaches are possible: we can either 'left shift' the multiplicand during the operations, or we can 'right shift' the bytes or registers that are storing the result.

Before showing some typical code for an 8-bit multiplication, we need to understand the general ideas behind creating '16-bit shifts'. Generally, the left shift operations available on our microprocessors will push bit7 into the carry flag. When attempting to left shift a 16-bit (2-byte) value, we can use a normal left shift on the low order byte as shown in Fig 11.

Bit7 falls into the carry flag, and to obtain a 16-bit shift we must shift this bit, now in the carry flag, into bit8 of the 16-bit number. In other words, we want to push this carry value into bit 0 of the high order byte. We need an instruction that performs a left shift and includes the carry, and the most commonly

LOW ORDER CONTENTS BEFORE LEFT SHIFT INSTRUCTION

	b7	b6	b5	b4	b3	b2	b1	b0

Carry flag ↑

LOW ORDER CONTENTS AFTER LEFT SHIFT INSTRUCTION

(b7)	b6	b5	b4	b3	b2	b1	b1	b0	0

↑ This bit is set to zero

Fig 11 Normal left shift on low order byte

HIGH ORDER CONTENTS BEFORE LEFT ROTATION

(C)	b7	b6	b5	b4	b3	b2	b1	b0

HIGH ORDER CONTENTS AFTER LEFT ROTATION

(b7)	b6	b5	b4	b3	b2	b1	b0	C

Fig 12 Rotation to the left

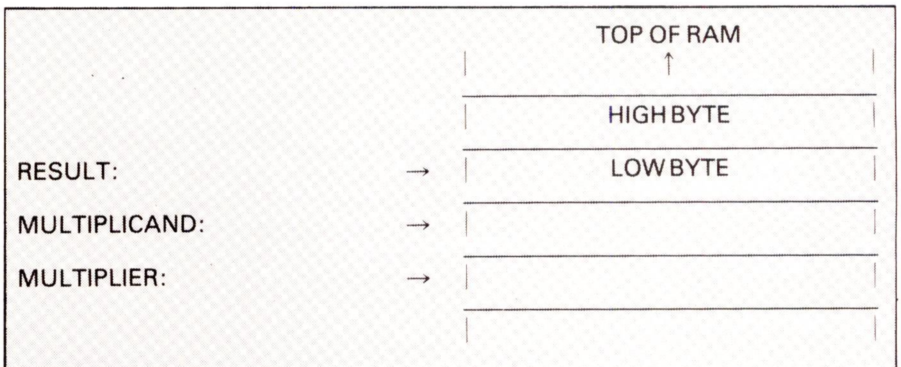


Fig 13 Layout in memory of 8-bit multiplication

implemented instructions that perform this are rotation instructions. Rotation to the left has the effect shown in Fig 12.

By utilising a combination of left shift on the low order byte and a left rotation (through the carry) on the high order byte, we can left shift a 16-bit number held in two bytes or in two 8-bit registers; the principles can be extended to any number of bytes as required. Instructions are usually available for the equivalent right shifts and right rotations. Occasionally, you will find 'tricks' being used to create 16-bit left shifts. One favourite on the Z80 is to use the double-register addition instructions to add a register pair to itself. For example, ADD HL,HL results in a 16-bit arithmetic left shift.

Let's see how these ideas help to produce a simple multiplication program that takes an 8-bit number held in a location labelled MULTIPLICAND, multiplies it by a second number held in location MULTIPLIER, and places the result into the two bytes starting from the lowest byte, which has been labelled RESULT (Fig 13).

Z80 multiply

The code in Fig 14 is split into two parts. Firstly, we load the registers with the following data: HL is loaded with the address of the multiplier, and register C is then loaded with the multiplier itself (using indirect addressing through HL). A 'bit count' of eight is loaded into the B register, and this will be used to count how many times we have gone through the 'multiplication loop'. The HL pair are then incremented so that they point to the multiplicand, which is placed in the E register using a LD E,(HL) instruction. Register D is set to zero because, although the multiplicand is only eight bits, we'll need 16 bits available as in the 16-bit left shift operation explained earlier. Finally, HL is set to zero and will be used to collect the result prior to storing it in locations RESULT and RESULT+1.

The second section of code is the actual multiplication. We use a right shift operation on the C register so that the least significant bit goes into the carry. This means that if the carry becomes 'set', then the least significant bit was a '1'. The carry flag is tested and if it has not been set, the partial product is zero and we skip the addition. Before moving on to the start of the loop again,

```
                LD      HL,MULTIPLIER          ;HL points to multiplier
                LD      C,(HL)                 ;Get multiplier in C register
                LD      B,8                    ;B is used as a 'bit' counter
                INC     HL                     ;Now HL points to
                                               multiplicand
                LD      E,(HL)                 ;Get multiplicand in E
                                               register
                LD      D,0                    ;Now DE = multiplicand !
                LD      HL,0                   ;HL will be used to hold
                                               result
MULTIPLY:       SRL     C                      ;Least sig but (multiplier)
                                               into carry
                JR      NC,SKIP                ;Indicates least sig bit is
                                               zero
                ADD     HL,DE                  ;Add partial product to
                                               result
SKIP            SLA     E                      ;Left shift multiplicand low
                                               byte
                RL      D                      ;Left rotate high byte
                                               through carry
                DEC     B                      ;Decrease bit counter
                JP      NZ,MULTIPLY            ;Do next bit
                LD      (RESULT),HL            ;Store result
```

Fig 14 Z80 8-bit multiplication

```
                LD      HL,(MULTIPLIER—1)      ;Get multiplier in H register
                LD      L,0                    ;Clear to zero
                LD      B,8                    ;B is used as a 'bit' counter
                LD      DE,MULTIPLICAND        ;Get multiplicand in E
                                               register
                LD      D,0                    ;Now DE = multiplicand !
MULTIPLY:       ADD     HL,HL                  ;16-bit left shift
                JR      NC,SKIP                ;Indicates least sig bit is
                                               zero
                ADD     HL,DE                  ;Add partial product to
                                               result
SKIP:           DJNZ    MULTIPLY               ;Do next bit
                LD      (RESULT),HL            ;Store result
```

Fig 15 Z80 8-bit multiplication version two

```
                LXI     H,(MULTIPLIER—1)       ;Get multiplier in H register
                MVI     L,0                    ;Clear to zero
                MVI     B,8                    ;B is used as a 'bit' counter
                LXI     D,MULTIPLICAND         ;Get multiplicand in E
                                               register
                MVI     D,0                    ;Now DE = multiplicand!
MULTIPLY:       DAD     H                      ;16-bit left shift
                JNC     SKIP                   ;Indicates least sig bit is
                                               zero
                DAD     D                      ;Add partial product to
                                               result
SKIP:           DCR     B                      ;Decrease counter
                JNZ     MULTIPLY               ;Do next bit
                SHLD    RESULT                 ;Store result
```

Fig 16 8080 8-bit multiplication

the DE pair are shifted using a left shift followed by a left rotation, and the 'bit counter' B is decreased. If B is not zero we repeat the loop again, otherwise the final result is stored in RESULT and RESULT+1.

This 'first attempt' code can be shortened and improved in several ways. The Z80 has a combined 'decrement and relative jump on not zero' instruction. It operates using the B register as the counter and decreases the B register by 1, and if B<>0, the relative jump is performed. Another improvement is also possible, but is less obvious. If the Multiplier is placed in the H register and the L register set to zero, the instruction ADD HL,HL will perform a 16-bit left shift. As the multiplier is shifted out during processing, we create room to store the result in HL.

To take advantage of this arrangement we must shift the multiplier to the LEFT, meaning that we deal with the most significant partial product first. We can also 'tighten up' the initial loading code by loading HL as a register pair starting one byte *below* the multiplier (so that the multiplier goes into the H register). The L register can be cleared after this 16-bit load in readiness for receiving the result. A similar 'trick' can be used to load the multiplicand into the E register.

These improvements have been made in the version shown in Fig 15.

Multiplication 8080

Translation to 8080 form is straightforward. All the improvements made in the second Z80 version can be implemented on the 8080 except for the automated DJNZ instruction. Relative jumps are not supported, so normal jump instructions are used in the loop (Fig 16).

6502 multiply

On the 6502, we cannot use any 16-bit 'paired registers', but we can create similar effects by considering the accumulator as the high byte of such a pair, and a memory location as the equivalent low byte. Such a combination can be shifted in the same way as explained earlier. The X register can be utilised as a 'bit counter', and an LSR (logical shift right) instruction can be used to push the least significant bits of the multiplier into the carry flag; this is used to decide whether or not to add the multiplicand.

In the example shown in Fig 17 the multiplicand is not shifted, it is just added to the accumulator. We right shift the 'accumulator memory byte' 16-bit pair using ROR instructions, and this provides an equivalent alternative.

```
                LDA  #0
                STA  RESULT
LDX             #8
MULTIPLY:       LSR  MULTIPLIER
                BCC  SKIP
                CLC
                ADC  MULTIPLICAND
SKIP:           ROR  A
                ROR  RESULT
                DEX
                BNE  MULTIPLY
                STA  RESULT+1
```

Fig 17 6502 8-bit multiplication

Did you try the left shift experiment suggested last month? If you did, you will have found that shifting a number to the left is equivalent to multiplying the number by 2. Similarly, two left shifts are equivalent to multiplying by 4. In general, an 'n bit' left shift will multiply the value by 2 raised to the power 'n'.

END

Practical Pick

The Pick operating system is not simply a collection of base functions, but one of the few complete software offerings providing all the requirements for the user — a full database management system, enquiry and programming languages, editors and utilities. In part one of a two-part feature, David O'Byrne examines this operating 'environment'.

The term 'operating system' is increasingly used to refer to those elements of software that handle the base functions of a computer system: the routing of I/O to the various peripherals on the system, or the file access mechanism, for example. These functions are effectively transparent to the user in that as long as they operate successfully, the user need not be concerned with their precise mechanics.

However, the user will need to be familiar with those software features which provide a platform on which to build the applications — things like utilities, programming languages and editors. These features tend to be added on to the base operating system as extras, in some cases a variety of different products (and suppliers) being combined to provide all the required functions.

Viewed from this angle, the Pick operating system is badly named. It could more correctly be termed an 'environment', providing a completely integrated set of facilities.

Pick, as shown in Fig 1, is something of a sandwich. At the bottom are the 'base functions', the parts of the operating system which carry out those hidden jobs — managing the virtual memory system, or maintaining the variable length data structure. Above these are the intermediate functions, system-wide facilities providing a security system from initial logon down to file retrieval, update locking mechanisms, and data dictionary facilities for each and every file within the system, plus accounting statistics, maintained by the system and enabling the user to see at a glance the current state of the database.

Above these, and interfacing to the user, are the final tools, ranging from powerful word and text processing options, through programming and procedural languages, file enquiry/report formatting facilities and a comprehensive set of utilities — a computing environment.

Base functions

Here we see a complete virtual memory system which handles system software, user software and data, with the entire disk being seen as an extension of main memory. The virtual memory manager ensures that programs and information for active users are transferred from disk to memory as required, and that inactive users take up hardly any memory at all. This allows a minicomputer with a relatively small amount of memory (128k) to run as many as 12 active terminals at one time, although response will vary according to system performance and the mix of jobs being run.

All information within a Pick system is held in a completely variable length format, every byte on disk being held in records composed of variable length fields, sub-fields and sub-values. This scheme provides a very high degree of independence between data elements, as well as highly efficient disk storage utilisation. A simple change to the type or size of a field can be effected without having to restructure the file in any way — the records expand and contract according to the size of the actual data.

The third basic function provides a hash-encoded random access file access mechanism. Record's keys are passed through a highly efficient algorithm which provides the address of an area on disk where the record is to be stored; distribution is even and response times high. Additional file space is assigned dynamically as the file grows (and removed if it shrinks), making the system self-maintaining apart from a weekly or fortnightly reorganisation.

Database

The Pick relational database management system can be classified as another base function although, as with most database systems, the interpretation of which elements form the DBMS and which are separate is open to argument. One feature of the system is its suitability for the concatenated keys which form such an essential part of the relational model. These are handled quite happily by the file access system, and can easily be broken down for retrieval purposes into their component parts via data dictionaries.

Within any computer system the security of data is vital, and particularly so in one which prides itself on its ease of use and speedy data retrieval labels. For this reason, there are a number of ways in which the Pick user can restrict the flow of information without impairing service. The first line of defence is the usual 'logon password' requirement, one of the most under-estimated security tools. Stop unauthorised access at the front door, and the chance of a burglary is reduced substantially!

Once logged successfully on to the system, the user is allocated a privilege level which determines the powers

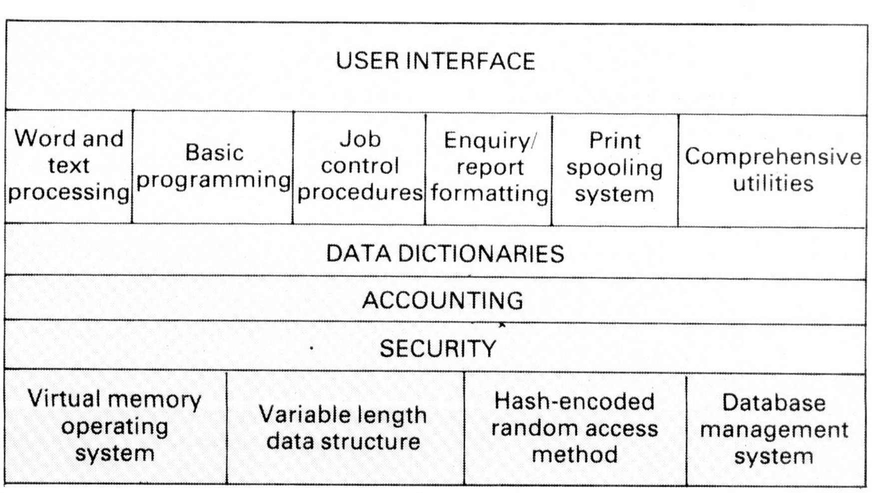


Fig 1 The Pick sandwich

available to him. A user of the highest privilege may look at data in different databases, create programs and adjust system parameters. The lower level users are restricted in their ability to change pre-defined commands or use advanced facilities (mag tape, debug, assembler, and so on). The intermediate privilege level allows command alteration and use of the mag tape, but prohibits use of data security utilities, assembler, and debug.

These are system-wide settings and are intended as general options. For more specific protection, sensitive commands can be removed altogether, the user tailoring the available commands to suit the requirements of the relevant user department. Powerful commands and facilities are restricted to those parts of the system used only by those in overall charge.

In addition, individual data, program or parameter files can be retrieval and/or update locked. This restricts access to users with retrieval or update keys which match the lock codes attributed to the relevant file.

Another system-wide feature is the accounting statistics, produced by a variety of tools, and showing the organisation of individual files and records up to a full picture of the system as it stands at any point. User logon and logoff times are automatically recorded, together with an indication of the amount of use they have made of the system.

Data dictionaries

As Pick is a database system, it makes use of data dictionary facilities on every file in the system. The enquiry facility operates via these dictionaries, and allows the interrogation of any file on the system with the same standard techniques.

Data dictionaries are a fundamental part of the Pick system. When a file is created, it is formed in two parts — data and dictionary. It's therefore possible to use Pick's enquiry language on any file in the system, whether it contains data, programs, PROCs or system data; all can be quickly and easily interrogated.

Data within a Pick system is usually stored in its raw form and expanded on output, with elements of the database frequently being concatenated or modified to fit a particular format. These functions are performed via dictionary conversions — operations carried out on a piece of data to transform it into output form.

Conversions take many forms. They can specify data extraction in either text, group or character form; elements of the data field can be extracted by direct reference. For example, T[2,3] returns the characters in positions 2 to 5 of the data fields by group extraction: that is, the code G2£1 returns '3' when processed on the field '1£2£3£4' or by character extraction, where only alphabetic or numeric characters are returned.

The dictionary can specify that output should be pattern, length or range checked, returning only those data elements which fit a specific range of values, match certain patterns or are of a specified length or range of lengths.

Data formatting can also be achieved (with codes enabling the user to convert dates and times from internal to external format or *vice versa*), to convert character strings to upper or lower case, or from their ASCII representation to the hexadecimal equivalent. In addition, numbers can be scaled, justified and formatted via decimal masking routines.

Mathematical functions and expressions can be carried out, albeit in Reverse Polish Notation. These operators permit the use of constants, literals, system parameters and substrings. Arithmetic operations and relational operators are fully supported, together with commands to alter the make-up of the stack itself.

In order to simplify these operations, a second mathematical notation is supported within Pick which allows the user to specify the functions in a much simpler syntactical form (similar to Basic), but with the added advantage of referring directly to other dictionary items, thus permitting relational algebra to be coded simply and efficiently.

These dictionary functions can make use of a file translation correlative to incorporate details from fields held in other files, which can then be processed via conversions to provide full relational operation.

Tools

One of the most obvious requirements is for a programming language, and in the Pick's case, this is a derivative of Basic. This has been modified in a number of areas to make full use of the features of the operating sytem. For example, the handling of variable length strings of up to 32k, magnetic tape, dynamic arrays, pattern matching, external subroutine calls, full screen handling with sophisticated cursor control, and so on.

Programs are input via the standard line editor and then compiled. A number of interesting compile options are available, including the ability to output a listing of the program complete with opcodes and the 'pseudo' assembly code generated by the compiler. The generation of variable and statements maps, so that the programmer can accurately monitor the execution of the program.

Data is represented within the program either as a variable or a constant, with variables containing single or multiple values (arrays), arrays being either dynamic or dimensioned and one (vector) or two (matrix) dimensional. Statements enable the programmer to locate, extract, replace, insert and delete data held in either a vector, a matrix or a variable.

Programs may pass 'common' data elements between them, and may call either internal or external subroutines. They may initiate any other process, be it a PROC, an enquiry language statement, or a utility. Control structures available to the programmer include CASE, FOR NEXT loops, IF THEN ELSE statements, LOOP UNTIL/WHILE and ON GOTO or GOSUB.

One of the most significant enhancements to the Pick Basic is the facility to convert data quickly and easily from one form to another. This is achieved by means of the ICONV and OCONV functions (Input/Output CONVersion).

Conversion

When creating the Pick database, the user is encouraged to store data in its 'raw' format, without decimal points, unnecessary fillers, leading zeroes, and so on. In order to illustrate how the data can be changed into the desired output form, let's take a look at a date conversion. On a Pick system, dates are usually held in 'internal' format: that is, a number representing the number of days since 31 December 1967, so that 27 October 1983 is held internally as 5779, making date calculations a simple arithmetical matter.

Similar conversions are available for a variety of operations, including formatting numeric fields, time (held as the number of seconds since midnight), converting decimal to hex (and *vice versa*), converting to and from packed fields, translating codes to values from other files, or calling user specified assembly routines for special tasks.

Another feature of Basic is its symbolic debugger (available only to users with the highest privilege level), which allows the user to interrupt the program either immediately it commences or at any subsequent time. Once within the debugger, the programmer may 'step through' the execution either in single or multiple steps, temporarily halt on execution of a specific line, or when certain logical conditions are met.

In addition, the programmer may display and/or alter any variable(s), display the actual source code lines, or alter the execution of the program by directing it to continue at a different point. Output can be directed to either screen or printer, and specific variables can be displayed whenever a break in execution occurs.

Advantages

The advantages of such a tool in debugging large programs are very real.

The programmer can identify and subsequently avoid bugs, alter data to test different routines, and investigate live problems without having to set up copy programs, data, and so on.

Next month: an extensive look at Pick commands, and its PROC (stored procedure) language. END

Array passing procedures

The more complex a program, the more variable it is likely to handle. While passing whole arrays from main to subroutines is enabled in languages such as Fortran, a few tricks are needed to do the same in BBC Basic! Andrew Bangham puts you in the picture.

In BBC Basic, a procedure is a subroutine which can be called by name and not line number. By declaring them as 'Local', variable names can be used in the procedure which would normally clash with variables of the same name in the rest of the program. This allows you to write, test, record and continue to use routines without having to remember exactly how they work. In other words, you can build up a library of powerful 'commands' to be used at any time.

There is nothing new in this method of using subroutines. The fact is that most Basic interpreters make it very difficult. BBC Basic is an exception.

Procedure

Let's look at what happens when a procedure is called. The Basic interpreter jumps to the named procedure, saving the return address (where it must return once finished) on a scratch pad or stack. It then saves the contents of each named variable on the stack, and substitutes the contents of the supplied variables. Finally, the existing contents of each variable mentioned in the Local declaration are also saved on the stack and initialled to zero.

Once the subroutine has been executed, the variables on the stack are put back into the variable names from which they came, and control passes to the return address. Consequently, all the variables which were local to the procedure resume their previous values. Is this exactly what you want? In the case of a circle drawing routine, nothing is to be returned from the procedure.

But what happens if you want the procedure to return information? Superficially, the only way is through common or global variables used in the same way as in a normal Basic subroutine, with all the disadvantages of common variable names.

However, BBC Basic does allow powerful functions. A function is just like a procedure except it returns one variable. One variable is better than none, but not as good as two or more. In Fortran, one often passes whole arrays both to and from subroutines, quite apart from being able to pass any number of single variables in either direction. The fact that this is ideal is shown by the enormous extent to which it is exploited in Fortran and other languages. Without this ability, programs and programmers would not have developed very far.

'All is not lost from Basic. Some versions . . . already allow subroutines to pass both arrays and single variables in both directions; BBC Basic is one of these. But you have to employ a trick to do it.'

All is not lost from Basic. Some versions, available on mainframe and minicomputers, already allow subroutines to pass both arrays and single variables in both directions; BBC Basic is one of these. But you have to employ a trick to do it. It's practical, and in many situations the advantages considerably outweigh the disadvantages. Fig 1 shows the three procedures which make it possible. Using a stack to store variables temporarily loses its attraction if that variable has 1000 elements, so a different strategy must be employed.

Rather than pass values or the contents of variables, the address of the variable should be passed: where it is, *not* what it is.

Let's consider an array called 'sadd' with 100 elements. As soon as it's dimensioned with DIM sadd(100), 100×5 (500) memory cells will be reserved to store the 100 values we wish to use. Note that five memory cells are required to store one real number.

Each memory element is located at a particular address. In the BBC Micro, a total of 64k (64×1024= 65536) memory elements can be addressed individually. There are 65536 addresses. Half of these are RAM and the other half ROM.

When the array 'sadd' is dimensioned, a continuous block of 500+11=511 memory elements are reserved by Basic: 500 to store the 500 real numbers, and 11 to describe the array, the array header.

Array header

What is the array header in BBC Basic? In the case of an array each variable is declared by using a DIM statement; BBC Basic examines the first letter of the variable, uses its ASCII code (the code for 's' is 115) to find a pointer located at memory address 1024+2×ASCII code: in our example 1024+2×115=1254. (One of the reasons the BBC Micro is fast is that the variable names are alphabetically sorted by first character.)

The pointer indicates the memory address where the header for the first variable beginning with 's' is located. The first two memory cells in the header itself (first two bytes) contain the address of the next variable, also begining with 's'. If there are no more, these two bytes simply contain zeros. After these two bytes come the remaining characters of the variable name including any modifiers, such as '$' or '%' and, in the case of arrays, '('. In our example, we would find the characters 'add('. The end of the variable name

```
L.1000,
1000 DEF FNfind(A$) :REM find variable address
1010 REM which can then be substituted into a dummy
1020 REM variable used within a procedure
1030 LOCAL B$,L%,N%,I%
1040 REM code for initial character
1050 I%=ASC(A$)
1060 REM extract next variable location
1070 L%=!(&400+I%+I%) AND &FFFF
1080 REM check remaining characters in name
1090 C$=MID$(A$,2)
1100 REPEAT
1110   IF L%<&1 THEN PRINT"NO SUCH VARIABLE ";A$:STOP
1120   REM substitute location into name A$
1130   REM and return existing address
1140   N%=L%
1150   B$=""
1160   L%=L%+2
1170   REPEAT
1180     IF ?L%<>0 THEN B$=B$+CHR$(?L%):L%=L%+1
1190     UNTIL ?L%=0
1200   L%=!N% AND &FFFF
1210   UNTIL B$=C$
1220 REM address of variable
1230 =N%
1240
1250 DEF FNsub(A$,L%) :REM substitute address L% into
1260 REM variable called A$, and return origional address
1270 REM of A$, which can then be put back using endproc
1280 LOCAL I%,J%
1290 J%=!ASC(A$) AND &FFFF
1300 I%=&400+2*ASC(A$)
1310 ?I%=L% MOD 256
1320 I%?1=L% DIV 256
1330 =J%
1340
1350 DEF PROCendproc(a$,J%)
1360 REM replace origional address of dummy variable
1370 REM effectively making the dummy variable (array) LOCAL
1380 LOCAL I%
1390 I%=ASC(a$)
1400 ?I%=J% MOD 256
1410 I%?1=J% DIV 256
1420 ENDPROC
```

Fig 1 Three BBC Basic procedures

itself is marked by a memory cell containing zero. Thus, the example would have a header seven plus bytes long. After the header comes the data. Real number data is stored in five bytes per number, and integers in four bytes per number.

String data is slightly different. There are two bytes containing the address of the actual string: one byte which gives the number of bytes reserved for the string and one byte which describes the current length of the strings; and, finally, the string itself.

In the example, the array header for 'sadd(100), is found at the two byte address given by 1024+2×115=1254. The header will start with two bytes containing zero unless another variable is declared beginning with 's'. For example, 'smart', or an array called 'smooch(', (in which case these two bytes will point to that variable). The remaining bytes in the header (that is, up to the next zero byte) contain the rest of the variable name. In this case, 'add(' (hexadecimal codes &62, &64 &64 &28, finishing with &00). Note that the first bracket of the array is included in the header. All the variables, except special variables @% to Z%, are found in the same way.

This technique can be used to find the address of 'sadd(' by using the function FNfind("sadd("). Fig 1 shows this function. The name of the variable to be found is passed as a string, in this case 'sadd('. The ASCII code of the first character of string 'sadd(' is found using the function ASC(). The procedure than loops, trying to match the remaining characters 'add(' with the bytes of the first variable beginning with 's'. If it fails, it skips to the next variable using the location given by the first two bytes. If a match is found, the address of the variable is returned by the function to the calling routine.

'Rather than pass values or the contents of variables, the address of the variable should be passed: where it is, not *what it is.'*

Having declared any variable, its address can immediately be found. It is convenient to use a consistent nomenclature. For example, the suffix 'add' (for address) can be used on any variable you wish to pass round using this technique. Its address 'saddRA%', is then called R standing for real, and A for array. All the examples in this article use this convention. Languages which explicitly allow addresses to be used to represent variables have other, mandatory conventions.

Now we come the trick. We pass the address of array 'sadd(' to a procedure, PROCexample(saddRA%), for instance. The procedure then substitutes this address into the vector (or pointer) of the first character of the working variable name used in the procedure. Suppose PROCexample has to take whatever array of 100 numbers is passed, find its natural logarithm, and return the data ready-logged in the same array, it would have to contain a loop such as:

500 FOR I=1 TO 100
510 wadd(I)=LN(wadd(I))
520 NEXT I

where array name 'wadd(' is a working name used inside the procedure.

The substitution is made using PROCsub("wadd(",a%), which substitutes address 'a%' into the vector at 1024+2×119 (the ASCII code of 'w' is 119). Subsequently, any reference to 'wadd(' will direct attention to 'sadd('. The loop given above logs the array. When control returns from the procedure, 'sadd(' contains the modified data.

This has to be tidied up before it can be used seriously. To ensure that vectors to other variables beginning with 'w' are not lost, save the existing 'w' vector *before* substituting the temporary one, and reinstate it (using PROCendproc) before leaving the procedure. Note that 'wadd(' and 'sadd(' have the same suffix 'add('. (This is essential to allow the variables to be correctly recognised.) In other words, there is a constraint on the variable names that can be used. The names of variables you wish to pass around must differ from the working names used in the procedures by just the first letter. This still leaves 53 possible names for each of the types of variable (real, integer, strings).

Array passing technique

Fig 2 shows a complete example of this technique. The arrays to be transformed are declared and their addresses located, together with the address of the two variables used to store the array means. We then generate some dummy data to work on. To take logs of all the elements of the first array

BBC MICRO

```
L.
    5 REM variables which are to be passed around must
    6 REM differ from working variable names only by
    7 REM the first character
   10 DIM sadd(100) :saddRA%=FNfind("sadd(")
   20 DIM madd(500) :maddRA%=FNfind("madd(")
   30 saddmean=0     :saddmeanR%=FNfind("saddmean")
   40 maddmean=0     :maddmeanR%=FNfind("maddmean")
   50 saddsize=10 :maddsize=50
   60
   70 FOR I=1 TO saddsize:sadd(I)=RND(100):NEXT
   80 FOR I=1 TO maddsize:madd(I)=RND(100):NEXT
   90
   95 REM pass to/from procedure -- array address
   96 REM pass to procedure -- size of array
   97 REM receive from procedure -- mean
   98
  100 PROClog(saddRA%,saddsize,saddmeanR%)
  105 PRINT "Array sadd( ) now log'd and mean is ";saddmean
  110 PROClog(maddRA%,maddsize,maddmeanR%)
  120 PRINT "Array madd( ) now log'd and mean is ";maddmean
  130
  140 END
  150
  160
  200 DEF PROClog(A%,N%,M%)
  210 LOCAL I,sum
  214 REM *** the first character of the working variable
  215 REM *** name MUST not be used as the first character
  216 REM *** of another variable within this procedure
  220 B%=FNsub("wadd(",A%)  :C%=FNsub("xaddmean",M%)
  230
  240 sum=0
  250 FOR I=1 TO N% :sum=sum+wadd(I)
  260   wadd(I)=LOG(wadd(I))
  270   NEXT I
  280 xaddmean=sum/N%
  290
  300 PROCendproc("wadd(",B%)
  310 PROCendproc("mean",C%)
  312 REM All variables in the procedure have been local to
  313 REM the procedure
  320
  330 ENDPROC
```

Fig 2 Complete technique example

(sadd(100)), we call the procedure with sadd('s address, the number of elements it contains, and the address of the variable we wish to receive the array mean. PROClog() remembers the original address reserved for the working array (in case it was used elsewhere), and substitutes the new address.

Finally, it puts back the original working variable addresses and returns, having completed its task. The whole technique is repeated for the second array: it's extremely fast, straightforward and neat.

Fig 3 shows that using the conventional approach, it takes 70secs to run a program which sorts three arrays and returns the means and standard deviations. By passing addresses, the sorting and statistics are carried out in 35secs — twice as fast as the usual approach.

Furthermore, the sorting routine is incorporated into other programs much more easily. Fig 3 also demonstrates how long it takes some other versions of Basic; and it can be seen that an improvement in speed and convenience is still more dramatic.

BBC Basic array passing	31secs
BBC Basic conventional	70secs
BBC Basic Z80/CP/M	112secs
Microsoft Basic 4MHz CP/M	170secs

Fig 3 Timings for conventional approach

Conclusion

There is one drawback to the array passing technique. It's not a standard part of BBC Basic, so it doesn't work with BBC Basic working on a second processor, (though perhaps it could be adapted).

It's a real pity this technique isn't standard, and more of a pity that other versions of Basic do not include the facility. END

LEISURE LINES

by J J Clessa

Quickie

No prizes.

There are 10 socks in a drawer — five blue and five grey. Assuming it's too dark for me to see, what is the least number of socks I would have to take out to be sure of getting a pair the same colour?

Prize Puzzle

The Andersons have an only child
The Browns have two children
The Coopers have three children
The Dawsons have four children
The Edwards have five children
The Firths have six children

At Xmas, each family gave gifts of money to their children and altogether, exactly £1000 was given to the 21 children.

The children of the two Roman Catholic families each received an equal amount.

The children of the four remaining families also received an equal amount each, but it was twice as much as the amount given to the Roman Catholic children.

Which two families are Roman Catholic?

Answers, on postcards only please, to: Prize Puzzle July 1984, Leisure Lines, *PCW*, 62 Oxford Street, London W1 — to reach this office not later than 31 July 1984.

April Prize Puzzle

5	7	6
1	?	7
2	1	6

The winning entry came from Mr EP Adler of Hebden Bridge, West Yorks. Congratulations. END

Whether you're an existing user or just thinking about it, you'll find all your answers under our expert umbrella, here at the IBM System User Show.

Sponsored by the IBM System User magazine, Europe's leading publication in the field, the Show is already one of the largest computer events in the U.K. All the major companies will be there, with up to the minute Systems, hardware, software and services, plus an IBM compatible PC village, and much much more.

And to complement the Exhibition, there will be a major Congress, "IBM System '84" incorporating eight separate conferences of absolute importance to the IBM System User. Specially designed and organised by IBM researchers, Xephon, and covered by Xephon's unique satisfaction guarantee, the Conference and Exhibition together make up the one unmissable event in the 1984 IBM Users Calendar.

So whatever your interest, be it mainframe, mini, or micro, make a date. September 3rd, 4th & 5th, Olympia 2, London. For further information return the coupon, or call Mario Meoli or Tanya Wright on 01-837 3699 NOW.

- ☐ Please send me ☐ complimentary tickets to the IBM System User Show.
- ☐ Please send me details of "IBM Systems '84" Conference, organised by Xephon.
- ☐ Please send me information about exhibiting at the IBM System User Show.
- ☐ I would like to apply for a regular free monthly copy of IBM System User magazine.

Name	
Job Title	
Company	
Address	
Post Code	
Tel:	

Return to IBM System User Show, EMAP International Exhibitions, Durrant House, 8 Herbal Hill, London EC1R 5JB.

A3. PCW 2.7

3/4 Sept (10am to 6pm) 5 Sept (10am to 4.30pm) Olympia 2, Kensington, London

BIBLIOFILE

In this month's literary selection, Linnet Evans ponders over important social issues, learns about Logo and looks forward to the fifth computer generation.

The New Agenda

Author: Francis Kinsman
Publisher: Spencer Stuart Management Consultants, Brook House, 113 Park Lane, London W1Y 4HJ
Price: £9.25 (+ 75p p&p)

'What do you imagine will be the most important social issues facing British managements by 1990?' This was the question that Francis Kinsman was commissioned to present to the boardrooms last year. *The New Agenda* aims to showcase the responses.

Thirty people 'ultimately connected with the leading edge of British management' were interviewed, the majority from private or public industry. As such, the inclusion was glaringly obvious of just one trade union official and two women (journalists) on the roster. Lone voices have their troubles too. Was every other potential candidate disinterested in this new era techno-village game, too busy, or just not invited? Although a broader spectrum of backgrounds would very likely have made the question(s) more complex than they already are, the loss of this potential input clouds the rest of the book.

What it does is question, insistantly and obsessively, many of the traditional ways and means which are seen as prolonging the birth of this post-industrial society. With a career-for-life no longer sacrosanct or, perhaps, practicable, says Kinsman, businesses could help their employees and themselves by a flexible mix of retraining, agreed redundancy and re-contracting on a self-employed basis. Enhanced communications and reciprocal trust between management and workforce can only facilitate this new approach.

As its title suggests, *The New Agenda* is — or aims to be — more of a discussion paper than a stockpile of solutions. Being a slim and well-dressed volume, it makes a quick and mildly entertaining read. It's apparent that the views and experiences of the thirty candidates have been presented largely to support the self-styled 'free-lance futurist's' visions, rather than to extend or counter them. The *Agenda's* brevity may also explain why there's dangerously little economic content: new dignity for the professionally unemployed, yes, but who pays for it?

The Naked Computer

Authors: Jack B Rochester & John Gantz
Publisher: Arlington Books
Price: £9.95 (hardback)

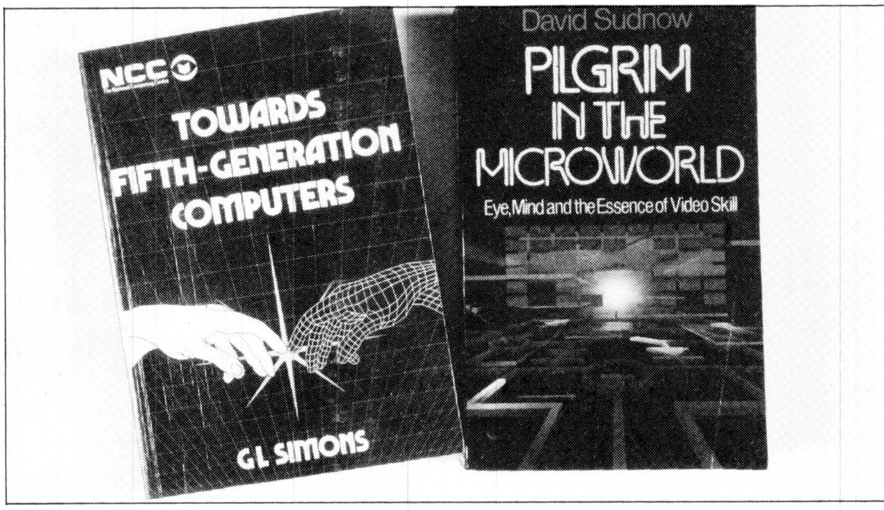
Visiting friends in foreign parts recently, and glancing through their bogside reading matter, I found myself thumbing a colour catalogue from a London bookseller. Among the biographies, nature rambles and radical chic on offer to those far from home, was *The Naked Computer*.

And that's the sort of book it is. Surprisingly sober with its monochrome photos and smart little press cartoons, *TNC* is in the business of building a bridge over troubled waters, of bringing it all back home. It's absolute proof that the computer world is big enough to have generated a bookful of tall/short stories. More importantly, it shows that general punters, even under the shade of the coconut tree, are now big enough to read them.

Interleaved with tales from the woods are literally innumerable facts and figures: top computer millionaires — it's H-P's David Packard weighing in at $1,000M; a safe-as-milk interview with *persona* totally *gratis* Adam Osborne; wilting computer poetry and gentle jibes at IBM, and almost all of it with the gentlest whiff of Inside Stories. As the authors put it, *TNC* is 'alayperson's almanac of computer lore, wizardry, personalities, memorabilia, world records, mind blowers . . .'. Give me strength! Give me more!

Material is arranged more or less generically by chapters, making it an easy one to dip into. A decent index is also thankfully provided should any serious investigation be required.

Undoubtedly, the authors put in a fair bit of groundwork in sifting through five years of press cuttings and talking shop with suitable partners on the golf course. What they have made of it is as classless, WASPish and homely as Oklahoma, as transient and nagging as the industry itself. No damn use at all to expatriates — except as a splendid new sourcebook for after-dinner stories.



Pilgrim in the Microworld

Author: David Sudnow
Publisher: Heinemann
Price: £5.95

If *The Naked Computer* is the spoonfed version of lore and law, then *Pilgrim in the Microworld* has to be fork and knife.

The plot is very simple. A sometime New York professor of sociology (and author, incidentally, of a fine popular treatise, *Passing On: The Social Organisation of Dying*), David Sudnow is at something of a crossroads in his life. Picking up his teenage son from a games arcade, he has his first vicarious taste of video games. A few pages later, he's obtained a colour TV and a copy of Atari's *Breakout*. Breaking out takes, apparently, most of the following three months of Sudnow's life. It certainly takes up most of this sweatily paradoxical but very readable book.

The oldstyle *Breakout* is a visually neat affair involving a single paddle at the foot of the screen and a six-layer wall towards the top. The rules are straightforward too, or so it seems: each time the player's paddle-driven ball hits the wall, a brick is knocked out. The basic object is to chop through all six layers; the ultimate object is to eliminate all remaining bricks within the span of the three serves.

Most of us occasional video players will intellectualise a game as much as anything to justify the time spent on it. Few would deign or dare to say: 'Here I am with my first authentic video experience, going for the last brick like any kid in an arcade, palms wet, mouth dry, nerve endings interfaced in nanoseconds . . .' — and the telephone ringing, unanswered. In American literature, Jack Kerouac and Robert Persig have done it before: now, David Sudnow does the tradition proud.

Introducing Logo

Author: Boris Allan
Publisher: Granada Publications
Price: £5.95

A lot of people today know a little about Logo. The number of books and other documentation on the market hasn't yet matched the pop/hype interest in these and other facets of this language. This is probably due to the old chestnuts of distribution and identity — not quite a backwater of educational psychology, nor a direct replacement in the classroom for CAL, and never a rival around the family fireside to BBC Basic. For the residents of 44 Acacia Avenue anxious to make a sensible choice for their kids, or simply to pull in some background knowledge, there's virtually nothing to go by.

This has to be part of the reasoning behind the recent offering from the prolific and often provocative Dr Boris Allan. *Introducing Logo* is just what you'd hope for — a short but sturdy book covering all the necessaries, past present and possibly future, of the gospel according to Seymour Papert.

Allan's first line of attack is practical, with a clutch of hands-on FD-50's at work before the first page is through. It illustrates the Logo philosophy beautifully: learning through thinking through doing. It's also an elegant way of unfolding some of the similarities and differences of various dialects as they arise — a task which Peter Ross in his worthy precedent *Logo Programming* (Addison-Wesley) keeps firmly till the end.

But if *Introducing Logo* sharpens the knife a little on this point, it's in other respects a pretty much open book. Arithmetic functions and lists complement the *de rigeur* screen graphics– there's no crawling on the floor with a tin of turtle wax here! Boris Allan deliberately avoids making comparisons (with other languages, for instance) outside the scope of the book, and concentrates throughout on drawing out the principles behind the practice of Logo itself.

A very worthwhile book: I only wish it kept up the momentum at the end with references and/or addresses.

Towards Fifth Generation Computers

Author: GL Simons
Publisher: NCC Publications
Price: £10.50

Geoff Simons will be known to many for a host of NCC titles, notably his trenchent *Privacy in the Computer Age*. Here, faced with a future where systems are by definition 'more powerful, more flexible, more competent, more intelligent', he constructs a tidy cat's cradle between two heavily-documented events in the recent past.

The International Conference held in 1981 in Tokyo, which gathered up some of the stray threads of previous years, mapped the foundations of architecture and applications that form our general understanding of 'fifth generation' as a concept. Prominent among these is the extension from data-based to knowledge-based systems. AI, expert systems and man/machine communications thus follow very close on the heels of more general questions of facilities, languages, and so on.

Since the Tokyo junket, some of these nominations have come closer to reality. The author cites the J[1]ll supermicroprocessor implementation of the PDP 11/70, and research into gallium arsenide as a silicon substitute, as current stages on the way. Software models from conference papers are similarly fleshed out with live developments, mainly from the US. Much pondering is given to Japan's apparent low commitment to software development.

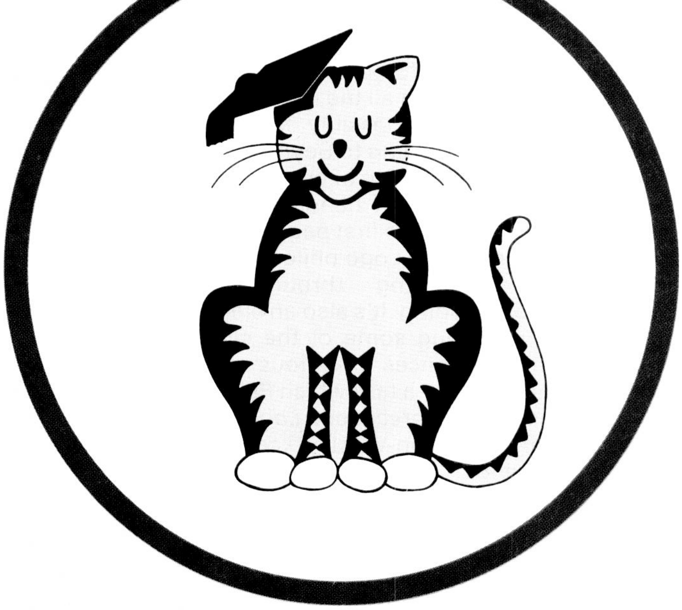
A year later, the UK responded with the Alvey report, Simons treading gingerly here around the Government's muffled response. Beyond this final chapter lie a workable index and thorough bibliography. This may yet give some leads to ESPRIT and other stones left necessarily unturned in this handbook.

Almost always, *Towards Fifth Generation Computers* is easy to read and follow. Very occasionally, a clump of technical detail crops up unheralded, clouding over what's otherwise a very accessible book for the keen layperson, and one which shouldn't date too soon. The tighter, more reasoned abstractions in *Towards* make a welcome contrast to projections in *The New Agenda*, although the benign projections of the Japanese may prove just as unattainable.

Overall, it's an appropriate and sympathetic look in both directions which achieves entirely what it sets out to do.

END

CHESHIRE CAT
EDUCATIONAL SERIES
from
AMPALSOFT



CHESHIRE CAT

The First name in Educational Software.

An exciting range of top quality programs

Available for BBC, Electron, Dragon 64, Dragon 32.
Available shortly for Commodore 64, Spectrum 48K.

RETAILER ENQUIRIES WELCOME

Ampal Computer Services Ltd.,
31 Woodbridge Road, Darby Green, Blackwater,
Camberley, Surrey.
Tel: (0252) 876677.

Available from selected branches
Boots, W. H. Smith and Dragon Data Ltd
and other good computer stores

MICRO JARGON

Newcomers start here

This is our unique quick-reference guide, reprinted every month, to help our readers pick their way through the most important pieces of (necessary) jargon found in PCW. *While it's in no way totally comprehensive, we trust you'll find it a useful introduction. Happy microcomputing!*

Probably the first thing you noticed on picking up this magazine for the first time was the enormous amount of unintelligible-looking jargon. In the words of *The Hitch-hiker's Guide to the Galaxy:* Don't panic! Baffling as it may sound, the jargon does actually serve a useful purpose. It's a lot easier to say VDU, for example, than 'the screen on which the computer's output is displayed.' This guide is intended to help you find your way around some of the more common 'buzzwords' you're likely to come across in the pages of *PCW.*

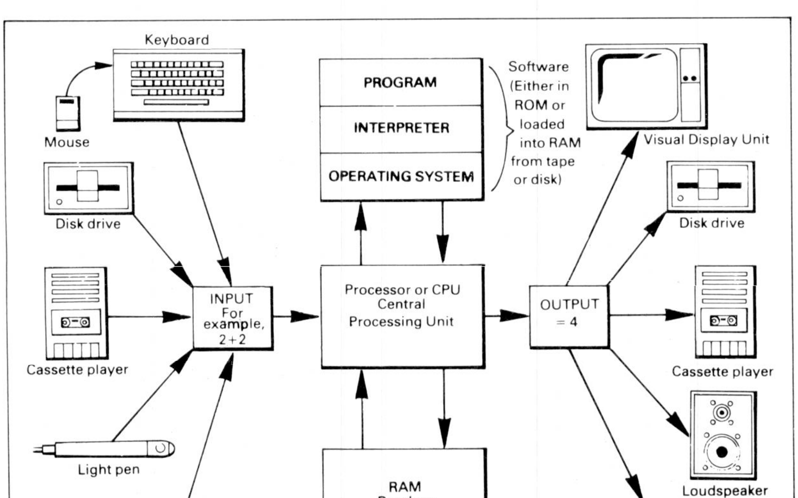
For those completely new to computing, let's start with the question: What is a microcomputer? We can think of a micro as: a general-purpose device in contrast to a typewriter, which can only be used for typing; a calculator, for performing calculations; a filing cabinet, for filing information, to name just a few of its functions. A micro can do all these things and more.

If it's to be of any use, a general-purpose device needs some way of knowing what to do. We do this by giving the computer a set of logical instructions called a **program.** The general term for computer programs is **software.** Every other part of a microcomputer system is known as **hardware**: 'If you can touch it, it's hardware.'

Programming

Programs must be written in a form the micro can recognise and act on — this is achieved by writing the instructions in a **code** known as a **computer language.** There are literally hundreds of different languages around, the most popular of these being **Basic.** Basic is an acronym of **B**eginners' **A**ll-purpose **S**ymbolic **I**nstruction **C**ode. Although originally intended as a simple introductory language, Basic is now a powerful and widely used language in its own right.

Other languages you're likely to come across in *PCW* are **Forth, Pascal, Logo, C** and **Comal** to name but a few. These are known as **high level** languages because they approach the sophistication of a human language. You'll also see references in *PCW* to the **low level** languages, **assembly language** and **machine code.** We'll look at these in a moment.



The heart of a micro, the workhorse, is the **processor** or **C**entral **P**rocessing **U**nit (**CPU**). The processor usually consists of a single silicon chip. As with computer languages, there are a number of different types of processor available, the **Z80, 6502, 6800** and **8088** being just a handful (literally!) of the types in common use. The processor is nothing magical — it's just a bunch of electronic circuits. It's definitely not a 'brain'.

As it's electronic, the processor's circuitry can be in one of two states: on or off. We represent these two states by **binary** (base two) notation, the two binary digits (known as **'bits'**) being 0 and 1. It's possible to program computers in binary notation, otherwise known as machine code (or machine language) programming.

Machine code is called a low level language because it operates at a level close to that 'understood' by the processor. Languages like Basic are known as high level languages because they are symbolic, operating at a level easily understood by people but not directly understood by the processor.

Between high level languages and machine code is a low level language known as assembly language or, colloquially, **assembler.** This is a mnemonic code using symbols which the processor can quickly convert to machine code.

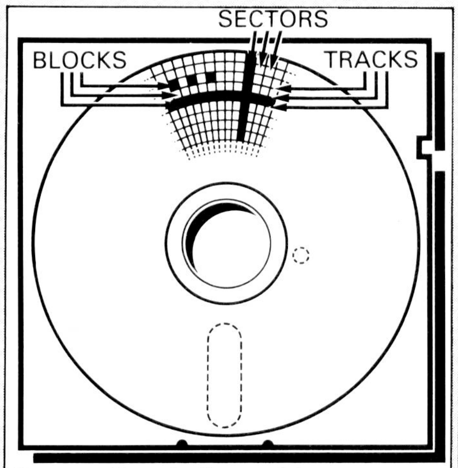
Since everything has to be converted into binary form before the processor can make sense of it, we need some sort of code to represent each character to be processed by the computer. In order to simplify communication between computers, a number of standard codes have been agreed on. The most widely used of these codes is the **A**merican **S**tandard **C**ode for **I**nformation **I**nterchange, **ASCII.** This system assigns each character a decimal number which the processor can then convert to its binary equivalent.

A program written in a high level language must be converted into binary before the processor can carry out its instructions. We could of course do this manually, but since this is exactly the sort of tedious job computers were designed to do for us, it makes much more sense to write a program to do it.

There are two types of program to do this translation for us.

The first of these is a **compiler** which translates our whole program permanently into machine code. When we **compile** a program, the original high level language version is called the **source code** while the compiled copy is called the **object code.** Compiled programs are fast to run but hard to edit. If

we want to change a compiled program, we either have to edit it in machine code (extremely difficult) or we have to go back to a copy of the source code. For this reason there is a second translation program: an **interpreter.** An interpreter waits until we actually **run** (use) the program, then translates one line at a time into machine code — leaving the program in its original high level



Cross-section of a floppy disk

language. This makes it slower to run than a compiled program, but easier to edit.

There are two unusual Basic words you're likely to come across: **POKE** and **PEEK.** When you program in a high level language, you are normally unable to choose in which part of the machine's memory the processor will store things. This makes programming easier as you don't need to worry about memory locations, but slows down the program since the processor has to 'look up' addresses for you. Using the POKE command, however, you can 'poke' a value directly into a desired memory address. 'POKE 10000,56', for example, puts the value 56 into memory location 10000. PEEK allows you to examine the content of a particular memory address. If you were to follow the above poke with 'PEEK (10000)', the computer would respond by displaying the value 56. POKEing and PEEKing is normally done to increase program speed, but may also allow us to do things which could not be done through Basic.

Memory

So far, we have a processor and a program. Since a computer needs somewhere to store programs and data, it needs some kind of **memory.** There are two types of memory: **Read Only Memory (ROM)** and the badly-named **Random Access Memory (RAM).** ROM is so-called because the processor can 'read' (get things out of) its contents, but is unable to 'write to' (put things in) it.

ROM is used to store **firmware,** the name given to software permanently available on the machine. An interpreter is a typical example of firmware (stick with it: it gets easier!).

RAM differs from ROM in two important ways. Firstly, you can write to it as well as read from it. This means that the processor can use it to store both the program it is running and **data** (information). The second important difference is that RAM needs a constant power supply to retain its contents: as soon as you switch the computer off, you lose your program and data.

There is a type of RAM, known as **CMOS RAM,** which requires only a tiny amount of power to retain its contents. This is found in portable computers like the Tandy 100 and the Gavilan MC. It is usually powered by small ni-cad batteries so that programs and data are retained even when the main power is switched off. At present, CMOS RAM is extremely expensive and is not likely to be used in desktop machines for a little while yet. (CMOS stands for **C**omplementary **M**etal **O**xide **S**emiconductor).

Memory is described in terms of the number of characters we can store in it. Each character is represented by an 8 bit binary number. 8 bits make one **byte** and 1024 bytes make one **Kilobyte** or **1k**. 32k, for example, means that the computer can store about 32000 characters in its memory. If 1024 sounds like an odd number, remember that everything is based on the binary system, thus 1,2,4,8,16 . . . 1024 being the nearest binary multiple to 1000.

While we're on the subject of bits, you'll often see computers and their processors described in terms of their **bit power: 8-bit, 16-bit, 32:16-bit** and so on. This is a means of describing how large a binary number the processor can handle in one chunk. A binary number, incidentally, is known — confusingly — as a **word.** An 8-bit processor, for example, can handle 8-bit words, that is, up to 11111111 (255 in decimal). Anything larger than this has to be broken down into manageable chunks before it can be processed.

A 16-bit machine can handle bigger chunks of data at a time. This means it can handle ('**address**') larger amounts of memory at one time. This is why most 8-bit machines have a maximum of 64k RAM while 16-bit micros usually have 128k upwards.

As 16-bit processors can handle larger words than an 8-bit machine, they ought to be twice as fast. In practice, however, there is a little more to it than that. While it may take a 16-bit machine half as long to work out that 2+2=4, the actual processing is only part of the story.

The result of the calculation has to be placed into the appropriate memory location, passed to the screen or whatever is required. The transfers to and from the processor are often made in 8-bit form; this is why you'll hear people arguing that certain processors are not 'true' 16-bit. If the problem has to be handed to the processor in 8-bit form, turned into 16-bit, calculated and then the result turned back into 8-bit for transfer elsewhere, there may be little or no saving in time over an 8-bit system.

The other factor affecting speed is that the actual processing may form only a small part of the overall operation. A word processor, for example, spends most of its time passing files to and from disk and waiting for the user to type the next character. The processing itself consumes very little time. And if you look at the Benchmarks summary (*PCW*, December 1983, pp. 238-241), you'll see some 8-bit machines beating their 16-bit rivals — even in processor-bound operations like the *PCW* Benchmarks.

Returning to the subject of RAM for a moment, a word of warning: Don't rush out with your new-found understanding to buy the machine offering you the most RAM for your money. Quite aside from the fact that the amount of RAM is by no means the only consideration when buying a micro (no matter how much manufacturers may stress it), different machines use differing amounts of RAM for things like graphics. Always check how much RAM is actually available to the user for program storage. Machines which proudly proclaim '64k' may well leave you with less than half of this in which to store Basic programs and data.

Back up storage

There are numerous forms of **permanent** or **back up storage,** but by far the most common are **floppy disk, floppy tape** and **cassette.**

Floppy disks or diskettes are circular pieces of thin plastic coated with a magnetic recording surface similar to that of tapes. The disk, which is enclosed in a protective card cover, is placed in a **disk drive.** Disk drives comprise a high-speed motor to rotate the disk and a **read/write head** to record and 'play back' programs and data.

The disk is divided into concentric rings called **tracks** (similar to the tracks on an LP) which are in turn divided into small **blocks** by spoke-like divisions called **sectors.**

There are two methods for dividing the disk into sectors. One method is called **hard sectoring,** where holes punched in the disk mark the sectors, and the other is **soft sectoring** where the sectors are marked magnetically. The reason that disks from one machine can't be read by a different make is that each manufacturer has its own way of dividing up the disk. Recently, however, manufacturers have apparently begun to acknowledge

that this situation can't go on forever, and they are working on making their disks compatible.

Since the computer needs some way of organising the disk, we have a program called a **Disk Operating System (DOS)**, usually known simply as the **Operating System (OS)**. The operating system does all the 'housekeeping' of the disks, working out where to put things, letting the user know what is on the disk, copying from one disk to another and so on. As you might expect by now, there are lots of different operating systems available, each with its own advantages and disadvantages. The three most popular OSs are **CP/M** (**C**ontrol **P**rogram for **M**icros), **MS-DOS** (**M**icro**S**oft **D**isk **O**perating **S**ystem) and **PC-DOS** (**P**ersonal **C**omputer **D**isk **O**perating **S**ystem). MS-DOS and PC-DOS, incidentally, are all but identical.

Disks can support what are known as **random access files**. That is, you can randomly choose a point in a file and the drive head will move directly to that point. You can then edit the file, and only the blocks affected will be rewritten. The rest of the file remains unchanged.

Floppy disks provide a reasonably fast and efficient form of secondary storage and are cost-effective for business machines. For home computers, however, the usual form of program and data storage is on ordinary cassette tape using a standard cassette recorder. This method of storage is slow and unreliable, but is very cheap and adequate for games, for example.

Cassettes can support only **serial access files**. That is, whenever a file is to be edited, the whole file must be written back to the tape. This makes certain applications — word processing being a prime example — extremely tedious.

Floppy tape drives are a compromise between speed and cost. They use a small continuous loop tape which, like a disk, is divided into blocks. Floppy tape drives rely on serial access files, but by rotating the tape at high speed and using the block markers, they can simulate random access files. The Sinclair Microdrive is a floppy tape drive.

Another type of disk you'll see referred to is the **hard disk**. This is an extremely efficient method of storing large amounts of data. Hard disk capacity generally starts at around 10**Mbytes** (10 million bytes) and rises to . . . well, you name it. Besides offering a much greater capacity than floppies, hard disks are more reliable and considerably faster. They are, however, much more expensive than floppy drives.

Input/output

Since computers need some way of communicating with the outside world, we need **input** and **output** devices. Input and output devices include all manner of things from hard disk units to light pens, but the minimum requirement for most applications is a typewriter-style **keyboard** for input and a TV-like **Visual Display Unit** for output. The Visual Display Unit is variously referred to as a **VDU, Cathode Ray Tube (CRT)** and **monitor**.

The various component parts of a computer system (processor, keyboard, VDU, disk drives, and so on, may all be built into a single unit or they may be separate, connected by cables.

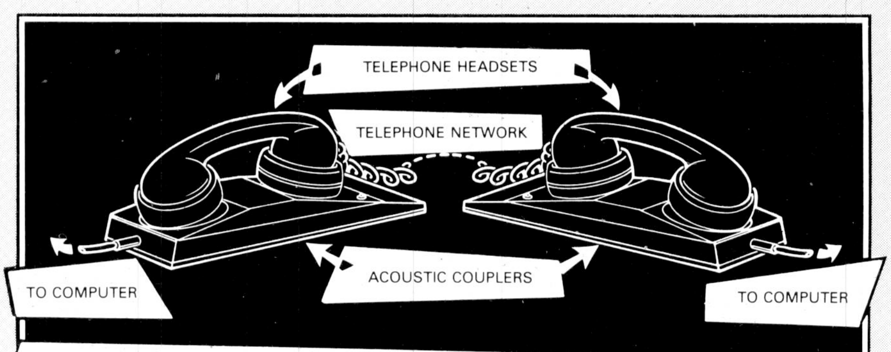
Take this paragraph slowly and it will make sense! When a computer communicates with an outside device, be it a printer or another computer, it does so in one of two forms — **parallel** or **serial**. Parallel **input/output (I/O)** requires a number of parallel wires. Each wire carries one bit, so with eight wires we can transmit/receive information one byte at a time (8 bits = one byte, remember). Serial 1/0, in contrast, uses a single wire to transmit a series of bits one at a time (that's why it's called serial), with extra bits to mark the beginning and end of each byte.

To enable different devices to communicate with each other in this way, standards have been agreed for different **interfaces**. An interface is simply a piece of circuitry used to connect two or more devices. The most common stardard serial interface is the **RS232** (or **V24**) while the Centronics standard is popular for parallel interfaces.

Networks

When two computers want to communicate with each other over a distance, there are again two ways of doing it (nothing is ever clear-cut in the world of micros — you'll get used to it). Both methods use the public phone network. The first is known as an **acoustic coupler**. This simply plugs into your computer, and has a receptacle into which you place your telephone handset. The acoustic coupler is convenient in that you can unplug it from one computer and plug it into another one in a matter of seconds. They are generally slow, however, and prone to interference.

The alternative method is to use a **modem**. Unlike an acoustic coupler, a modem is wired into the telephone system and you should get permission for this from British Telecom.



Computer-to-computer communications using acoustic couplers.

A term you'll hear used in connection with acoustic couplers and modems is **baud rate**. The baud rate is a measure of the speed at which a device can transmit and receive data. You can safely think of the baud rate as being bits-per-second, though the accurate definition is a little more complex. Therefore, a 300-baud modem can transmit/receive data at the rate of 300 bits (about 50 characters) per second.

A 1200/75 modem means that it receives at 1200 baud but transmits at 75. Most modems are 1200/75 and acoustic couplers 300/300. By way of comparison, saving programs to cassette is normally done at between 300 and 1500 baud.

Finally, communications between computers is either **full** or **half duplex**. Full duplex is when the machine receiving the data echoes it back to the machine transmitting it and says 'This is what I think you said — is that right?'. If it's wrong, the section will be transmitted again. Half duplex is where no checking is made. If you're ever unsure of which to use, start with full duplex. If everything you type appears on your display twice, then you should switch to half duplex.

Database

A database allows you to store, process and report on structured information. Most of the cheaper packages are based on a traditional card index where each card about an individual, order or item of stock is stored in a single record and a group of like records is stored in a file (corresponding to the index card box). Sophisticated packages can relate several files together, so that you can process groups of dissimilar but related records.

Spreadsheet

Spreadsheet software is useful to anyone who regularly uses a calculator. The VDU acts like a 'window' on a large sheet of numbers — neatly laid out in rows and columns, occasionally interspersed with text headings. The user is able to shift the window to the point of interest and so enter text. The rest of the calculation is displayed immediately with automatic recalculations throughout. END

TRANSACTION FILE

● NEWBRAIN A; Manual, beginners guide, and tape, Newbrain disected; Zen, Chess, Adventurer and other games tapes. £150 ono. Tel: Thanet (0843) 821745.
● ITT 2020 (APPLE][). 48k RAM, 12k ROM, 2k monitor, + 10k Applesoft. Also Integer Basic ROM card + disk drive interface card, + Pal T.V. modulator card, V.G.C. Hardly used. £300 ono. Tel: 'Keir' (0268) 43079 eve or weekends.
● ATARI 400, 48k, 810 cassette, Basic, Assembler, cartridge games, manuals and books. £195. Tel: Cambridge 322900.
● SHARP MZ-80k. Completely integrated system. Including numerous programs, like Easidata, machine code, data-base. Lots of games, Chess, Childrens Maths, Basic extensions. Basic Tutorial. All £185, can deliver. Good condition. Tel: 01-778 9932.
● TUSCAN 64k S100. Micro computer, CPM based with double density single sided disc drive, + 9in black and white monitor and Dolphin BD80P printer 125cps £550 ono. Tel: Bookham (0372) 54555 eve only.
● JUPITER ACE. Expanded to 64k with some software tapes, user magazines, + compatible Sony cassette recorder £60. Also Commodore Chessmate with board and pieces £25. Tel: (021) 357 3913 (eves).
● ATARI software disk and cartridge. All originals under half price, s.a.e. list or Tel: (021) 357 3913 (eve). TJ Millward, Oakeswell, Hill Lane, Great Barr, Birmingham, B43 6NA (sale of personal collection).
● NEWBRAIN. 2x200k disks, 64k expansion, power supply, monitor, + books. Complete system cost £1200+. Offers around £800. Tel: (0900) 84465 (eve).
● TUSCAN CP/M business computer. Twin 5¼in SSDD disk drives, 64k static RAM card, 80x24 display card, S100 bus, £850 or offer considered. Tel: Staines 58708 (eve).
● SHARP MZ-80k, 48k. Complete with some software, perfect condition £125. View Hampstead. Tel: (01) 435 3588.
● SHARP MZ80A. 3 months old, + range of software and manuals, (Built in screen and cassette). £320 ono. + MZ80 AEU printer, 3 months old, £260 ono. Tel: (0272) 622029 after 7pm.
● WANTED for CBM700, Superscript II. Also Superbase and Calcresult. Please contact Lionel Tun, Elm Lodge, Cricket Green, Mitcham, Surrey, CR4 4LB.
● SORCERER 48k, monitor, two cassette recorders, WP PAC, Basic, + Zetu Assembler and 5 games. Also acoustic modem. £375 ono. All in good working order. Dr. M Liddle, Ladywell Hospital, Salford, M5 2AA.
● ATARI 16k, Memory modules (cased type), (2) £20 each. Atari 822. Thermal printer £100 ono. Wabash 8in SS/SD, 8in disks, (new unformatted) (25) £12.50 per 5. Tel: Swanley (0322) 62747.
● BASF 5¼in ⅔ height disk drive. New, complete with technical manual and five S/S D/D diskettes £100 ono. Tel: Dennis (051) 423 2471 (Liverpool area).
● BBC Model B. Acorn DFS. 100k drive, MX100 printer, EPROM programmer and eraser. Wordwise, joysticks, disks, manuals, books, software. Worth £1400+, sell £850 ono or split. Tel: (091) 284 3677 eve.
● COMMODORE 64 word processors, One cartridge, £27, one disc, uses icons, £30. Also address book and mailing labels program. £5. Tel: (0491) 39497.
● NEWBRAIN AD 32k, PSU, battery module, cassette and video leads, manuals, software, £180. Tel: Milton Keynes, (0908) 604614. After 7pm ask for John.
● PET 4032. Single disc, printer, 40/80 col. conversion, netkit, RS232 port, business ROM, + other ROMS and software, W.P., Calc, etc, £750 the lot. Tel: (0285) 61843.
● COMMODORE 64, Joystick + interface for any recorder. Software including: Pooyan, Manic Miner, Pipeline, Matrix, Hover Bovver, Revenge, £165 or swap for Atari 800 etc. Tel: Newark (0636) 79786, ask for Andrew.
● HEWLETT Packard, HP2671G. Graphics printer HP9826, WHH option II, Basic 2.0, ROM board with extra 512k memory, and R6B board. Tel: Much Wenlock (0952) 727328.
● SEIKOSHA GP100A, Mark 2 dot matrix printer. As new with warranty, £160 ono. York 490109, delivery included.
● EPSON HX20-MC, 16k. Manuals, case charger, paper, ribbons, labels. Software: Texteditor with sideways printout 80x18, calculator, graphics, Linear-Equations, Regression. Very good condition £390 ono. Tel: Reading 666143.
● SHARP MZ80B. Basic, Pascal, Assembler. All manuals and cover £550 ono. Tel: Shoeburyness (03708) 5276.
● SWAP 4032 9in screen PET with integral reset key. Simple wordpro, monitor + toolkit plus games software incl. Chess, For Commodore 64 compatible printer or disk drive. Details on Milverton 400651.
● CENTRONICS 779 dot matrix parallel printer. Good condition and prints perfectly. Variable type sizes, friction feed, rather large but very reliable. £100 ono. Contact 'Keir' (0268) 43079 eve or weekends.
● CROMEMCO system. Three computers with 3102 terminal and VDU dual 1.2MB 8in F/D. Centronics printer, 16FDC controller, TV art card, CDos(CP/M), latest DBase II software, 32k Basic etc. Documents £2900 (new £8000). Tel: (01) 521 7733.
● APPLE II, Micro Modeller and other business software. For sale or part exchange. For CBM 64 compatible dot matrix or daisy wheel printer. Tel: (0704) 66156 eve.
● UNUSED T.A.B.S. accounts system with generator, purchase and nominal ledger, payroll. Full instructions, disc and dongle. Offers to Lang Tel: (061) 799 5644.
● FIXED disc drive, B9493-18 2x9½MByte. 150cps line printer. Burroughs B80 computer 8in discs, all usable and useful for spares. Will separate. Lewis. Tel: (061) 799 5015.
● APPLE II, 48k. Europlus: 2 disc drives, 9in monitor, silent printout, Visicalc, Visidex, Applepost mailing list, Dos 33, Appleplot, Applepost, Dow Jones, news + portfolio, + Minimodem 3001, Bargain price £990. Tel: (01) 627 0565.
● NEWBRAIN model AD, with battery module. 7 months old, hardly used. £300 ono. Tel: Dady, Bedford 767332. Urgent sale required.
● UK101, 16k. 300/600 baud, tape recorder, interfaced teletype printer. Software and full documentation. £150. Tel: (0532) 586169.
● APPLE II+ hardware (disk-drives clock-cards cool-stack). Business software, Visidex, Visiplot, Applewriter II, T.A.S.C.), Utilities, (Toolkit, Locksmith 4.1), games, (Choplifter, Beer-run), + much more. Tel: (0373) 67353 after 6.30pm for details.
● WANTED! Good colour computer in exchange for complete photographic system, (Durst enlarger, Pentax K1000, Vivitar lenses etc), Offers please. Tel: (01) 542 2747 (eve).
● CASIO FX-602P wanted. No documents or add-ons required. Write B.C.Bird 82 Hillview Road, Peterculter, Aberdeen, AB1 0UB, or Tel: (0224) 641356 during office hours.
● DIGITIZER. TRS-80 26-1195, but works into any RS-232 pinpoint accuracy but rather slow. Cost £500. Offers. Tel: Kings Lynn 810021.
● SHARP MZ80K, 48k. Basic, Zen editor assembler, manuals, Basic and monitor listings, reset, combined monitor/tapedeck. Database, bank/address, games programs, cover, original packing. Excellent condition. £230 ono. Halifax. Tel: (0422) 56725.
● HP-41CV. Manuals, case, overlays. All excellent condition, £100. Phil Tearne, Kidlington. Tel: (08675) 2539.
● APPLE 64k, Europlus. Disk drive and controller monitor III, stand, language card, Screenmaster, 80col card, Grappler printer interface, Applewriter II, Visicalc, £800. Tel: (0203) 382861.
● VIDEO GENIE EG3003, 48k. With sound, integral cassette, lots of software, Invaders, Pools Forecaster etc. All as new, £165. Tel: Robson (0782) 631673 (Stoke).
● SINCLAIR SPECTRUM, 48k. Two microdrives + interface 1, + 12 blank microdrive tapes and demo tape. Software and books. Still under guarantee. In original packing £290. Tel: Portsmouth 819492.
● SEIKOSHA GP100A. Graphic printer, Centronics parallel interface, original packing, £145. Also Spectrum 48k + 2 microdrives and interface + tapes for microdrives + software and books. Guarantee, offers? Tel: Portsmouth 819492.
● PET 32k. 3032, + 3040 disk drive, 3022 printer, Visicalc, integrated accounts program, and loads of software £1440. Tel: (01) 580 6427 9.30-5pm.
● NASCOM 3 complete system. 32k RAM, Zeap Assembler, G808 Eprom programmer with software, Hitachi b/w monitor, cassette recorder, software and full documentation, £400. Tel: 01-828 6045 after 6.30pm.
● BBC model B. 4 shaft weaving designer cassette £7.95. Fordham 8 St. Leonards Way, Ashley Heath, Ringwood, Hants, BH24 2HS.
● PET 3008 32k. With cassette, full size keyboard. As new, with many programs. Contains toolkit, mikro superchip and reset key. £350. Tel: Vic, work (01) 977 3222 ex 3966, Home (01) 543 2379 after 6pm.
● FREE MZ-80K 48k with integral VDU and cassette. When you buy stock control and database, plus many more programs and books included. Best reasonable offer secures. Tel: Runcorn (09285) 65851.
● BBC model B, 1.2OS. Watford DFS 1.20, 100k Cumana disk drive, £50 of games, books & leads. Altogether worth over £700, selling for £510 ono. Tel: 01-888 1884 (N. London).
● ACT Sirius 1, 128k. 1.2Mb drives, Supercalc, Software, Wordstar, Cobol compiler and editor, (business operating system) with manuals, little used. As new worth £3600, sell £2700. Tel: 01-455 3735 after 8pm.
● ANADEX DP9501 printer. As new. Takes very wide paper, 400mm approx, high speed dot matrix with home made trolley and base feed. Tel: Ballyconan (064887) 264 during working hours. Best offer secures.
● SHARP MZ80K, for sale. Very good condition. Tel: Gor Ramesh office (01) 245 9232 London, or home (0634) 47573. £250 or near offer. 74 Ingle Road, Chatham, Kent ME4 5SE.
● SHARP MZ80A. 80 column screen conversion, dual disk drives with interface box, Basic, m/c, Forth, over 100 games. Cost £1200, accept £790 ovno, or will consider splitting. Tel: 0634 405533.
● HEWLETT Packard 82143A thermal printer. Suitable for HP41C calculator. Rechargeable battery, mains charger, manual, 2 rolls thermal paper, boxed. Cost new £300+, will sell for £100 ovno. Tel: (0424) 217179.
● APPLE 2 Europlus. Twin disk drives, language card, RS232 card, bitstik, joystic, Hitachi 9in monitor, software including Forth, Pascal, Locksmith, assorted vidgames. £900, or haggle. Ron, Tel: (031) 667 2091, ask for committe room.
● NASCOM disk interface G805 £40, Polydos o/s disk/ROM complete £50. Micropower 64k RAM + PCG + Nascom 1 buffer suit Nascom 1 or 2 £40 or £100 the lot. All fully working. Tel: Thatcham (0635) 66072 eve.
● WANTED: Programs for Bills Of Materials Processing, Production Planning to run on Apple II, IBM-PC, CP/M. Further medical office, Law office, Hotel management systems. Write Peter Andersen, 41 Naesbyug DK-8270 Højbjerg Denmark.
● APPLE IIe. 3 drives, 2 controllers, 3 monitors, Z80 card, powercore. Centronics interface, Silentype, joystick paddles. Business software and games. With books and manuals. Will split £1900. Tel: Derby 668076.
● 32k PET. With toolkit and Rabbit and cassette unit. Over £70 worth of manuals, over 60 games etc. £390. Tel: (01) 868 9709.
● SHARP MZ-80A. 48k. Good condition, Sharp software package, manual, 18 months old. £325 ono. Tel: Mick on (01) 370 1908 after 6pm. Suitable for first time buyers.
● FOR sale: Tandy ModIII 48k. Disks, Centronics printer with £3000 software, consisting of word processors, business programs, languages, games. All for £2000 or vno. Tel: (01) 254 0286 for full details.
● APPLE II, 48k, disc drive, 16k RAM, Alf Synth, colour and clock cards. B/W monitor and large quantity of software + manuals, £650. Tel: Bracknell 59491 (eve hours only).
● Lynx, 96k. Virtually unused, in original box with all leads, plus "Lynx Computing" by Ian Sinclair, £220. Tel: Cardiff (0222) 30911 (after 6pm).
● APPLE II Europlus, 48k, 2 disk drives, Omnivision 80 column card, Dynasoft Pascal, Easywriter professional wordprocessor, Applewriter, CCA DMS, Pact Fan, Epson printer interface, £875. Tel: Tunbridge Wells 37266.
● Video Genie EG3003 16k RAM, 12k ROM, with 9in b/w VDU and Tandy DMP100 printer, cables, manuals. £200 ono. Beckenham, Kent. Tel: 01-466 6677 (eve only).
● Exchange Moto Guzzi V50 II 6700MLS, excellent condition, for disc and printer system compatible with BBC(B) approx price £800. Tel: (029) 13-2298.
● BBC-micro model-B including Watford DFS, 400k Cumana drive, 16k sideways RAM, 50 disks of games, languages utilities including many manuals. £650 ono. Tel: Bookham 54206 after 6pm, ask for Alan.

TRANSACTION FILE ADVERTISEMENT FORM

All Transaction File ads must be submitted by readers on this form or a photo-copy of this form. Maximum 30 words. Print one word per box, very clearly. Name, address and/or telephone number must be included in the 30 words. All ads must be accompanied by a flat fee of £2.50. Make cheques or POs payable to Personal Computer World. Ads accepted from private readers only. Ads cannot be repeated (unless sent in on another form) and we cannot guarantee to print an ad in any specific issue. Please help our typesetter to help you by printing your ad very clearly. Send form to: Transaction File PCW, 62 Oxford Street, London W1A 2HG.

Please find enclosed my cheque/PO for £2.50 for the following Transaction File ad.

ACC NEWS

Good news for all affiliated clubs: you are now enjoying the benefits of insurance. Rupert Steele explains.

The ACC (Association of Computer Clubs) has been negotiating insurance cover for its affiliated clubs. Negotiations on cover for accidental damage to club or member's equipment are still continuing, but I am now in a position to make a formal announcement about the public liability insurance deal.

All UK-based (including Northern Ireland, but excluding Eire and Channel Islands) computer clubs affiliated to the ACC are now automatically included in the ACC's block public liability insurance policy. The policy, underwritten by The Commercial Union Group, will protect each club, its committee and individual members against claims made by the public for injury or damage to property arising out of club meetings, demonstrations and club social functions. The limit of protection for each claim will be £500,000 plus legal defence expenses, but without a limit to the number of claims that can be made.

This is an extremely valuable protection that would normally involve individual clubs in a substantial premium but, arranged on a block basis, the economy of scale allows the cover to be included *free* in the ACC's normal £6 affiliation fee.

Copies of the master policy held by ACC can be obtained from Douglas Mynett, 15 Sandy Lane South, Wallington, Surrey SM6 9QY (large SAE, please). In broad terms, the insurance will protect clubs against claims brought against them by the public following an accident causing either personal injury or property damage, and for which the club is legally liable due to negligence on the part of a club official or member.

Typical examples of relevant incidents are:

1 Faulty assembly of equipment leading to injury to a member of the audience or damage to the landlord's property.
2 Food poisoning following refreshments served at a club meeting.
3 Visitors to a meeting injured due to defect in the premises, of which the club should have been aware.

The policy applies to all officially organised club meetings held within the UK. Exhibitions and demonstrations to which guests and the public are invited will also be covered provided that entrance fees are not charged by the club. Protection applies to club meetings held on a fee (rather than subscription) basis or where guests are charged — if the club is a member club and not a commercial enterprise for the organisers. The policy does *not* cover liability arising from the use of road or rail vehicles, boats and/or aircraft.

It is the ACC's intention to maintain the block insurance, but if for any reason the policy is discontinued, either by the ACC or the underwriters, then the ACC will make reasonable efforts to notify affiliated clubs in writing.

The provision of the block insurance facility is an extra service, but the ACC is neither empowered nor able to accept responsibility for meeting any claims that may arise, the position of the Association being that of coordinator not insurer. If your club employs any staff, you will be aware that you must have arranged employer's liability insurance (the ACC does not coordinate this).

Local round-up

I am advised of ABUG — The Sheffield Acorn and BBC Micro User Group. It has a mixed membership with a variety of abilities and interests, but uses the BBC Micro almost exclusively. Social and formal meetings are held on the first and third Wednesday of each month. Contact John Fryer, 17 Edgedale Road, Sheffield S7 2BQ if you are interested.

From the western part of Cornwall, Steven Zenith writes to remind us of the 'Penwith Area Independent Computer Club' or PAICC. This now has many members, serves the whole area (including Penzance) and is running many activities including communications, although Prestel activity is limited by the need to make trunk calls. For more information, contact the chairman, Steven Zenith, Dragon Gate, 77 St John's Street, Hayle, Cornwall. The other club is rather smaller; it's a Dragon User Group in the St Austell area. The man to contact is Martin Starkie, 48 Old Roselyon Road, Middleway, Par, Cornwall PL24 2LN, or tel: Par 4922.

Mr Jim Turner, publicity officer of the East London Amateur Computer Club, has written a very detailed letter about his activities. The East London Club meets on the second and fourth Tuesday of each month at the Harrow Green Library, Leytonstone. Visitors are welcome (though asked to sign the visitors' book) to the meetings which run from 7-10pm. The first meeting is intended to be a lecture or talk on a micro subject, while the second is an informal session where members can discuss problems and ideas, and show off their 'toys' and clever programs. A very wide range of machines are used by club members. This month the club intends to assist the Youth Outreach Service, Barclay Road, Leytonstone to teach Basic to beginners during the school holidays; there are plans to hold classes for adults, too, to assist in meeting micros at work. Membership is £6 per year (£4 for juniors/pensioners). For more information write to Jim at 63 Millais Road, London E11 4HB, tel: (01) 558 3681 or call the chairman, Fred Linger on (01) 554 3288.

Now I'll turn the spotlight to the Southampton Amateur Computer Club. The club has its main meeting on the second Wednesday of each month at the Medical Sciences Building, Bassett Crescent East, between 7.30 and 10.30pm. It also has an active BBC group which meets separately on the last Friday of the month (same times) at the Crestwood Centre, Shakespeare Road, Eastleigh. On the last Saturday of

'Well, we've made a start. We've agreed to cut back the distribution of video games.'

the month, there is a very popular junior group which meets from 9am to noon at the Baptist Church, Bitterne Park. The club is active in a number of other areas including seminars at local libraries. Visitors are welcome at the meetings. For more information, write to Southampton Amateur Computer Club, The Crestwood Centre, Shakespeare Road, Eastleigh, Southampton.

And finally, this month, Mr A Cope of Hall Farm, New Road, Dilhorne, Stoke-on-Trent, Staffordshire ST10 2PQ writes to tell me of his new club. Open to any computer owner or non computer owner, the 'Mixed Bytes Computer Club' meets every other Thursday at Dilhorne Recreation Centre, New Road, Dilhorne. For more information write to Mr Cope.

For more information on the ACC, write to:
Rupert Steele
17 Lawrie Park Crescent
London
SE26 6HH
Tel: (01) 778 6824

END

Interested in setting up a Computer Town? Why not write for guidelines.

If you're new to computers, and would like some help and support from more experienced hobbyists, then Computer Towns are a good place to start. And if there is no Computer Town near you, why not start one of your own? All you need are a few interested people, a place to meet and a notice to advertise the meetings. A set of guidelines to assist people setting up Computer Towns is available by sending an A4 sae to Surya at *PCW*.

COMPUTER TOWN UK! CONTACTS

Chris Woodford
31 Hopley Road
Anslow
Burton-on-Trent
Staffordshire

Alan Hooley
21 Brammay Drive
Tottington
Bury BL8 3HS

Peter J Kiff
2 Ranelagh Grove
St Peter's in Thanet
Broadstairs
Kent CT10 2TE

John Byfield
Moonrakers
The Rutts
Bushey Heath
Herts WD2 1LH

Peter Earthy
46 High Street
Church Stretton
Shropshire SY6 6BX

Brigitte Gordon
18 Purbright Crescent
New Addington
Croydon CR0 0RT

Vernon Gifford
111 Selhurst Road
Croydon
London SE25 6LH

Derek Moody
2 Victoria Terrace
Dorchester
Dorset DT1 1LS

JO Dale
12 Poplar Road
Newtown
Powys SY16 2QS

Ray Skinner
22 Colsterdale Close
High Grange
Billingham
Cleveland

Keith Taylor
Carter Hydraulic Works
Thornbury
Bradford BD3 8HG

Peter Herring
Ordnance Road Library
Ordnance Road
Enfield
Middx

John Stephen Bone
2 Claremont Place
Gateshead
Tyne & Wear NE8 1TL

B J Candy
9 Oakwood Drive
Gloucester Gl3 3JF

Mike Sones
Gayton Library
Gayton Road
Harrow
Middx

John Barton
Ashford Main Library
Church Road
Ashford
Kent

Andrew Holyer
10 Masons Road
Mannings Heath
Horsham
Sussex RH13 6JP

Robin Bradbeer
Polytechnic of
North London
Holloway Road
London N7

Ted Ellerton
25 Beachdale
Winchmore Hill
London N21

John Mileham
RACS
147 Powis Street
London SE18 6JN

Vernon Quaintance
50 Beatrice Avenue
Norbury
London SW16 4UN

J G Batch
Central Library
Clapham Road
Lowestoft NR32 1DR

Brian Taylor
22 Millbrook
Leybourne
Nr Maidstone
Kent ME19 5QJ

Andrew Stoneman
135 Birchdale Avenue
Newcastle-Upon-Tyne

E N Ryan
15 Queens Square
Eastwood
Nottingham NG16 3BJ

Derek Knight or
Bob Carter
Rayners Lane Library
Imperial Drive
Rayners Lane
Middx

Patrick Colley
52 Queensway
Caversham Park
Village
Reading
Berks RG4 0SI

Bill Gibbings
2 Longholme Road
Retford
Notts DN22 6TU

Chris Cooper
110 Church Road
Hanwell
London W7

J M A Kilburn
(Headmaster)
Shawfield Norden
Community Middle
School
Shawfield Lane
Norden
Rochdale L12 7QR

Philip Joy
130 Rush Green Road
Romford
Essex

R Shipton
17 Woodlands Avenue
Eastcote
Ruislip
Middx

Paul Maddison
Gardenways
Chilworth
Southampton SO1 7JH

Roger Shears
181 Woodmill Lane
Bitterne Park
Southampton SO2 4PY

Richard Powell
22 Downham Court
South Shields
Tyne & Wear

Computer Town UK! is a rapidly expanding network of computer literacy centres where members of the public are given free access to all sorts of computer equipment. This is courtesy of those willing to offer time/resources. You can find a Computer Town anywhere — they're often in libraries or schools. The aim is to make micros enjoyable and non-threatening, so axe-grinding of any sort is banned. Guidelines are available for those interested in starting up their own 'Towns. Write to: Margaret Spooner, Computer Town UK!, PCW, 62 Oxford Street, London W1A 2HG. Remember to enclose an A4 SAE for your reply. Please don't ring for information as Computer Town UK! is entirely a spare time activity.

Mike Perry, Steve Collas or Dave Lee The Library Ealing Road Wembley Middx HA0 4BR Alan Potten	14 Foxmede Rivenhall End Witham Essex Alan Sutcliffe 4 Binfield Road Wokingham	Berks RG11 1SL Peter Stone or P Strangman Computing and Maths Dept The Polytechnic Wulfruna Street	WV1 1LY Tony Cartmell 54 Foregate Street Worcester WR1 1DX Martin Haugh Hayes Library	Golden Crescent Hayes Middx R L Saunders 14 St Nicholas Mount Hemel Hempstead Herts

BENCHMARKS

A listing of the Benchmarks used when evaluating micros is given below. An explanation can be found in the December '83 issue.

```
100 REM Benchmark 1
110 PRINT "S"
120 FOR K=1 TO 1000
130 NEXT K
140 PRINT "E"
150 END
```

```
100 REM Benchmark 2
110 PRINT "S"
120 K=0
130 K=K+1
140 IF K<1000 THEN 130
150 PRINT "E"
160 END
```

```
100 REM Benchmark 3
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/K*K+K-K
150 IF K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 4
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 K<1000 THEN 130
160 PRINT "E"
170 END
```

```
100 REM Benchmark 5
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K/2*3+4-5
150 GOSUB 190
160 IF K<1000 THEN 130
170 PRINT "E"
180 END
190 RETURN
```

```
100 REM Benchmark 6
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 220
170 FOR L=1 TO 5
180 NEXT L
190 IF K<1000 THEN 140
200 PRINT "E"
210 END
220 RETURN
```

```
100 REM Benchmark 7
110 PRINT "S"
120 K=0
130 DIM M(5)
140 K=K+1
150 A=K/2*3+4-5
160 GOSUB 230
170 FOR L=1 TO 5
180 M(L)=A
190NEXT L
200 IF K<1000 THEN 140
210 PRINT "E"
220 END
230 RETURN
```

```
100 REM Benchmark 8
110 PRINT "S"
120 K=0
130 K=K+1
140 A=K^2
150 B=LOG(K)
160 C=SIN(K)
170 IF K<1000 THEN 130
180 PRINT "E"
190 END
```

DIARY DATA

Readers are strongly advised to check details with exhibition organisers before making arrangements to avoid wasted journeys due to cancellations, printers' errors, etc.

Manchester	(Belle Vue), Compec North—Computers, Peripherals & Systems Ltd. Contact: Reed Exbns, (01) 643 8040	19-21 June
London	(Wembley Conference Centre), Local Networks and Dist'd Office Systems Exbn & Conf. Contact: Online Conferences Ltd, (01) 868 4466	3-5 July
London	(Novotel), PC User Show—IBM PC Software Exbn. Contact: EMAP Int Exbns Ltd, (01) 837 3699	3-5 July
London	(Barbican Centre), Micro Trade Exbn. Contact: Montbuild Ltd, (01) 486 1951	4-6 July
Las Vegas	National Computer Conference and Exbn. Contact: American Federation of Information, Processing Societies Inc, 1815N Lynn St, Arlington, VA22209	9-12 July
London	(Alexandra Pavilion), Electron & BBC Micro User Show. Contact: Database Publications, (061) 456 8383	19-22 July
Edinburgh	(Assembly Rooms), Scottish Personal Computer World Show. Contact: Scottish Industrial & Trade Exbns Ltd, (031) 225 5486	26-28 July

PROGRAMS

We regret that we are unable to accept any further program submissions for the time being. We have been inundated with programs, and simply cannot handle any more at the moment.
Apologies to those of you who have submitted programs and are awaiting a response. Processing submissions takes time, but all programs submitted to date will be acknowledged. Thanks for your patience!

This month's Program of the Month neatly complements BBC 'Sected', published last month. 'RAM Editor' allows you to examine and modify RAM in much the same way as 'Sected' does a disk.

'Timestar' is a highly addictive arcade-style game, again for the BBC. The principle of the game is simple; playing it isn't.

There are also two programs for the Spectrum. 'Supalanda' is a better-than-average version of 'Moon-lander', 'Big-print' a useful subroutine for Spectrum programmers.

'Frequency test' is a useful program for the electronically-minded MZ-80K owner, 'Grafkeys' is a time-saving utility for Sirius programmers.

Finally, three less popular machines get a look-in. The RML with a version of 'Millipede', the Vic-20 with a bizarre but fun game, and the Jupiter Ace with 'Avoider'.

Games
Scientific/mathematic
Business
Toolkit/utilities
Educational/Computer Aided Learning

Program of the Month
BBC Timestar
by Julian Clinton

'Timestar' is a fast-moving game loosely based on the arcade game 'Tempest'. It requires 32k RAM.

Your task is to safeguard a time gate from would-be invaders. The invaders will attempt to break through the gate by destroying it, section by section. A section is destroyed if an attacker reaches the outside of the gate. In the case of squiggles — a particularly rampant type of invader — the sections on either side of the one under attack are also destroyed.

You stop the invaders by using a flipper which moves around the outside of the gate. Use the left and right cursor keys to move, and the TAB key to fire. The flipper cannot cross a damaged section of the gate, so be careful not to trap it!

If this sounds confusing, a few minutes playing the game is the best form of explanation. If you want to change the keys to control the flipper or fire button, change the INKEY values in lines 1960-1980.

```
>
1000 REM ***************************
1010 REM **                       **
1020 REM **     TIME  STAR        **
1030 REM **                       **
1040 REM **  by Julian Clinton    **
1050 REM **     April 1984        **
1060 REM **                       **
1070 REM ***************************
1080 ON ERROR GOTO 3890
1090 MODE7
1100 PROC_INSTRUCTIONS
1110 MODE1
1120 PROC_ENVELOPES
1130 PROC_VARIABLES1
1140 PROC_VARIABLES2
1150 PROC_SCREEN
1160 REPEAT
1170   IF GOT%=NUM% PROC_WEAPON ELSE IF TRI% PROC_TRI ELSE IF EX% PROC_EX ELSE
IF PULSE% PROC_PULSE ELSE IF SKWIG% PROC_SKWIG
1180   IF SUM%>20+10*(SCREEN%)DIV4 SCREEN%=SCREEN%+1:SUM%=0:FOR S%=0 TO 20:SOUN
D 3,-15,100*((S%)MOD2)+20,2:NEXT:PROC_VARIABLES2:CLS:PROC_SCREEN
1190   IF LIFE%>0 AND FALL% PROC_NEWPOS
1200   IF LIFE%<1 MODE 7:PROC_HISCORE:MODE1:PROC_SCREEN
1210   UNTIL 0
1220 DEFPROC_INSTRUCTIONS
1230 FOR A%=1 TO 2
1240   PRINT TAB(0,A%)CHR$132;CHR$157;CHR$131;CHR$141;TAB(16,A%)"Time Star"
1250   NEXT
1260 PRINT'" You must protect your end of a star    gate from aliens at the far
 end.They     will attack you with various weapons,   some of which need to be hi
t twice."
1270 PRINT'" Triangles ........... 100 Points"
1280 PRINT" Crosses    ........... 150 Points"
```

PROGRAMS

```
1290 PRINT" Pulsers   ........... 200 Points"
1300 PRINT" Skwiggles ........... 300 Points"
1310 PRINT'" Skwiggles (blue/yellow V's) will        destroy 3 sections of the g
ate,the rest will destroy 1 section.If you move onto a damaged section,you will
plummet down the gate and be destroyed."
1320 PRINT" Use CURSOR RIGHT to move clockwise,    CURSOR LEFT to move anti-clo
ckwise,and  TAB to fire."
1330 PRINT'CHR$129;CHR$136"Press SPACE bar to begin........."
1340 *FX15,0
1350 REPEAT UNTIL GET=32
1360 ENDPROC
1370 DEFPROC_ENVELOPES
1380 ENVELOPE 1,1,-2,-2,-2,20,20,20,0,0,0,0,0,0
1390 ENVELOPE 2,1,2,2,2,20,20,20,120,0,0,-127,100,0
1400 ENVELOPE 3,1,2,-2,2,5,10,5,100,0,0,-127,80,0
1410 ENVELOPE 4,2,-2,-2,-2,20,20,20,100,0,0,-100,100,0
1420 ENDPROC
1430 DEFPROC_VARIABLES1
1440 DIM CO_ORDX%(23),CO_ORDY%(23),DIST%(3),TUBE%(3),BLAST%(11)
1450 FOR A%=0 TO 23
1460   READ CO_ORDX%(A%),CO_ORDY%(A%)
1470   NEXT
1480 RESTORE
1490 HI%=0:SCORE%=0:LIFE%=3:SCREEN%=0
1500 *FX9,5
1510 *FX10,5
1520 ENDPROC
1530 REM** DATA FOR STAR GATE NODES **
1540 DATA 32,4,28,16,16,20
1550 DATA 0,18,-16,20,-28,16
1560 DATA -32,4,-28,-8,-16,-12
1570 DATA 0,-10,16,-12,28,-8
1580 DATA 30,10,22,18,8,19
1590 DATA -8,19,-22,18,-30,10
1600 DATA -30,-2,-22,-10,-8,-11
1610 DATA 8,-11,22,-10,30,-2
1620 DEFPROC_VARIABLES2
1630 FOR A%=0 TO 11
1640   BLAST%(A%)=-1
1650   NEXT
1660 FOR A%=0 TO 3
1670   DIST%(A%)=0:TUBE%(A%)=-1
1680   NEXT
1690 SUM%=0
1700 PLACE%=RND(12)-1
1710 TRI%=0:EX%=0:SKWIG%=0:RIM%=0:PULSE%=0:NUM%=0
1720 FALL%=0:GOT%=0
1730 ENDPROC
1740 DEFPROC_SCREEN
1750 *FX15,0
1760 VDU29,640;300;23,8202;0;0;0;
1770 VDU19,3,4;0;19,2,7;0;
1780 GCOL 0,3
1790 FOR A%=2 TO 18 STEP 16
1800   MOVEA%*32,A%*4
1810   FOR B%=0 TO 12
1820     DRAW A%*CO_ORDX%((B%)MOD12),A%*CO_ORDY%((B%)MOD12)
1830     NEXT B%
1840   NEXT A%
1850 FOR B%=0 TO 11
1860   MOVE 2*CO_ORDX%(B%),2*CO_ORDY%(B%)
1870   DRAW 18*CO_ORDX%(B%),18*CO_ORDY%(B%)
1880   NEXT
1890 GCOL0,2
1900 MOVE 18*CO_ORDX%(PLACE%),18*CO_ORDY%(PLACE%):DRAW 20*CO_ORDX%(PLACE%+12),2
0*CO_ORDY%(PLACE%+12):DRAW 18*CO_ORDX%((PLACE%+1)MOD12),18*CO_ORDY%((PLACE%+1)MO
D12)
1910 COLOUR2
1920 PRINTTAB(8,2)"LIVES : ";LIFE%;TAB(22,2)"SCORE : ";SCORE%;TAB(8,4)"SCREEN:
";(SCREEN%)MOD4+1;TAB(22,4)"LEVEL : ";(SCREEN%)DIV4+1
1930 ENDPROC
1940 DEFPROC_KEYIN
1950 IF FALL% ENDPROC
1960 IF INKEY(-26) PROC_SHIFT(1):ENDPROC
1970 IF INKEY(-122) PROC_SHIFT(-1):ENDPROC
1980 IF INKEY(-97) PROC_FIRE
1990 ENDPROC
2000 DEFPROC_SHIFT(A%)
2010 PROC_DRAWPLACE(0)
2020 PLACE%=(PLACE%+A%)MOD12:IF PLACE%=-1 PLACE%=11
2030 IF NOT(BLAST%(PLACE%)) PROC_FALL:ENDPROC
2040 PROC_DRAWPLACE(2)
2050 ENDPROC
2060 DEFPROC_DRAWPLACE(C%)
2070 GCOL 0,C%
2080 MOVE 18*CO_ORDX%(PLACE%),18*CO_ORDY%(PLACE%):DRAW 20*CO_ORDX%((PLACE%)MOD1
2+12),20*CO_ORDY%((PLACE%)MOD12+12):DRAW 18*CO_ORDX%((PLACE%+1)MOD12),18*CO_ORDY
%((PLACE%+1)MOD12)
2090 ENDPROC
2100 DEFPROC_FIRE
2110 LOCAL A%,HIT%
2120 IF FALL% ENDPROC
2130 HIT%=0
2140 SOUND &11,1,250,8:SOUND &10,-15,7,8
2150 GCOL 0,2
2160 FORA%=0 TO 1
2170   MOVE 18*CO_ORDX%((PLACE%+A%)MOD12),18*CO_ORDY%((PLACE%+A%)MOD12):DRAW 2*
CO_ORDX%((PLACE%+A%)MOD12),2*CO_ORDY%((PLACE%+A%)MOD12)
2180   NEXT
2190 FOR A%=0 TO NUM%-1
2200   IF TUBE%(A%)=PLACE% THEN HIT%=-1
2210   NEXT
2220 GCOL0,3
2230 FORA%=0 TO 1
2240   MOVE 18*CO_ORDX%((PLACE%+A%)MOD12),18*CO_ORDY%((PLACE%+A%)MOD12):DRAW 2*
CO_ORDX%((PLACE%+A%)MOD12),2*CO_ORDY%((PLACE%+A%)MOD12)
2250   NEXT
2260 IF NOT HIT% ENDPROC
2270 PROC_HIT
2280 ENDPROC
2290 DEFPROC_POS(R%)
2300 LOCAL A%
2310 NUM%=RND(R%)
2320 FOR A%=0 TO NUM%-1
2330   DIST%(A%)=3+(SCREEN%)MOD4
2340   REPEAT
2350     TUBE%(A%)=RND(12)-1
2360     UNTIL BLAST%(TUBE%(A%)) OR RND(6)=6
2370   NEXT
2380 SUM%=SUM%+NUM%
2390 ENDPROC
2400 DEFPROC_WEAPON
2410 LOCAL R%
2420 R%=RND(9)
2430 GOT%=0
```

MICROMART

PROGRAMS

```
2440 IF R%<4 TRI%=-1:VDU19,1,9;0;:PROC_POS(3):SOUND &12,4,150,100:ENDPROC
2450 IF R%<7 EX%=-1:VDU19,1,10;0;:PROC_POS(2):SOUND &12,3,20,100:ENDPROC
2460 IF R%<9 PULSE%=-1:VDU19,1,8;0;:PROC_POS(2):SOUND &12,3,200,100:ENDPROC
2470 SKWIG%=-1:VDU19,1,11;0;:PROC_POS(2):SOUND &12,2,100,100
2480 ENDPROC
2490 DEFPROC_TRI
2500 FOR A%=0 TO NUM%-1
2510   IF TUBE%(A%)=-1 GOTO 2560
2520   PROC_DRAWTRI(0,DIST%(A%))
2530   DIST%(A%)=DIST%(A%)+1+(SCREEN%)DIV4
2540   IF DIST%(A%)>16 PROC_BLOCK(TUBE%(A%)):NUM%=NUM%-1:TRI%=0 ELSE PROC_DRAWT
RI(1,DIST%(A%))
2550   PROC_KEYIN
2560   NEXT
2570 IF GOT%=NUM% TRI%=0
2580 ENDPROC
2590 DEFPROC_DRAWTRI(C%,D%)
2600 GCOL 0,C%
2610 MOVE D%*CO_ORDX%(12+TUBE%(A%)),D%*CO_ORDY%(12+TUBE%(A%))
2620 DRAW (D%+1)*CO_ORDX%(TUBE%(A%)),(D%+1)*CO_ORDY%(TUBE%(A%))
2630 DRAW (D%+1)*CO_ORDX%((TUBE%(A%)+1)MOD12),(D%+1)*CO_ORDY%((TUBE%(A%)+1)MOD1
2)
2640 DRAW D%*CO_ORDX%(12+TUBE%(A%)),D%*CO_ORDY%(12+TUBE%(A%))
2650 ENDPROC
2660 DEFPROC_EX
2670 LOCAL A%
2680 FOR A%=0 TO NUM%-1
2690   IF TUBE%(A%)=-1 GOTO2740
2700   PROC_DRAWEX(0,DIST%(A%))
2710   DIST%(A%)=DIST%(A%)+1+(SCREEN%)DIV4
2720   IF DIST%(A%)>16 PROC_BLOCK(TUBE%(A%)):NUM%=NUM%-1:EX%=0 ELSE PROC_DRAWEX
(1,DIST%(A%))
2730   PROC_KEYIN
2740   NEXT
2750 IF GOT%=NUM% EX%=0
2760 ENDPROC
2770 DEFPROC_DRAWEX(C%,D%)
2780 GCOL 0,C%
2790 MOVE D%*CO_ORDX%(TUBE%(A%)),D%*CO_ORDY%(TUBE%(A%))
2800 DRAW (D%+1)*CO_ORDX%((TUBE%(A%)+1)MOD12),(D%+1)*CO_ORDY%((TUBE%(A%)+1)MOD1
2)
2810 MOVE (D%+1)*CO_ORDX%(TUBE%(A%)),(D%+1)*CO_ORDY%(TUBE%(A%))
2820 DRAW D%*CO_ORDX%((TUBE%(A%)+1)MOD12),D%*CO_ORDY%((TUBE%(A%)+1)MOD12)
2830 ENDPROC
2840 DEFPROC_PULSE
2850 LOCAL A%
2860 FOR A%=0 TO NUM%-1
2870   IF TUBE%(A%)=-1 GOTO 2920
2880   PROC_DRAWPULSE(0,DIST%(A%))
2890   DIST%(A%)=DIST%(A%)+1+(SCREEN%)DIV4
2900   IF DIST%(A%)>17 PROC_BLOCK(TUBE%(A%)):NUM%=NUM%-1:PULSE%=0 ELSE PROC_DRA
WPULSE(1,DIST%(A%))
2910   PROC_KEYIN
2920   NEXT
2930 IF GOT%=NUM% PULSE%=0
2940 ENDPROC
2950 DEFPROC_DRAWPULSE(C%,D%)
2960 GCOL 0,C%
2970 VDU5
2980 MOVE D%*CO_ORDX%(12+TUBE%(A%))-16,D%*CO_ORDY%(12+TUBE%(A%))+16
2990 PRINT CHR$111
3000 VDU4
3010 ENDPROC
3020 DEFPROC_SKWIG
3030 LOCAL A%
3040 FOR A%=0 TO NUM%-1
3050   IF TUBE%(A%)=-1 GOTO 3100
3060   PROC_DRAWSKWIG(0,DIST%(A%))
3070   DIST%(A%)=DIST%(A%)+1+(SCREEN%)DIV4
3080   IF DIST%(A%)>17 PROC_RIM(TUBE%(A%)):NUM%=NUM%-1 ELSE PROC_DRAWSKWIG(1,DI
ST%(A%))
3090   PROC_KEYIN
3100   NEXT
3110 IF GOT%=NUM% SKWIG%=0
3120 ENDPROC
3130 DEFPROC_DRAWSKWIG(C%,D%)
3140 GCOL 0,C%
3150 MOVE (D%-2)*CO_ORDX%(TUBE%(A%)),(D%-2)*CO_ORDY%(TUBE%(A%))
3160 DRAW (D%-1)*CO_ORDX%((TUBE%(A%)+1)MOD12),(D%-1)*CO_ORDY%((TUBE%(A%)+1)MOD1
2)
3170 DRAW D%*CO_ORDX%(TUBE%(A%)),D%*CO_ORDY%(TUBE%(A%))
3180 ENDPROC
3190 DEFPROC_RIM(N%)
3200 PROC_BLOCK(N%)
3210 PROC_BLOCK((N%+1)MOD12)
3220 IF N%=0 PROC_BLOCK(11) ELSE PROC_BLOCK((N%-1)MOD12)
3230 ENDPROC
3240 DEFPROC_BLOCK(N%)
3250 IF BLAST%(N%) SOUND &11,1,150,10:SOUND &10,-15,7,10
3260 GCOL0,0
3270 MOVE 18*CO_ORDX%(N%),18*CO_ORDY%(N%)
3280 DRAW 18*CO_ORDX%((N%+1)MOD12),18*CO_ORDY%((N%+1)MOD12)
3290 BLAST%(N%)=0
3300 ENDPROC
3310 DEFPROC_FALL
3320 LOCAL A%,B%
3330 *FX15,0
3340 SOUND &11,1,200,12:SOUND &10,-15,7,12
3350 FOR A%=18 TO 2 STEP -1
3360   FOR B%=2 TO 0 STEP -2
3370     GCOL 0,B%
3380     MOVE A%*CO_ORDX%(PLACE%),A%*CO_ORDY%(PLACE%)
3390     DRAW (A%+2)*CO_ORDX%(12+PLACE%),(A%+2)*CO_ORDY%(12+PLACE%)
3400     DRAW A%*CO_ORDX%((PLACE%+1)MOD12),A%*CO_ORDY%((PLACE%+1)MOD12)
3410     NEXT B%
3420   NEXT A%
3430 FOR A%=-15 TO 0
3440   SOUND 0,A%,6,3
3450   NEXT
3460 LIFE%=LIFE%-1
3470 COLOUR 2:PRINTTAB(16,2);LIFE%
3480 FALL%=-1
3490 ENDPROC
3500 DEFPROC_HIT
3510 LOCAL A%
3520 A%=-1
3530 REPEAT
3540   A%=A%+1
3550   UNTIL PLACE%=TUBE%(A%)
3560 IF TRI% PROC_DRAWTRI(0,DIST%(A%)):PROC_SCORE(100):PROC_SWITCH(A%):ENDPROC
3570 IF EX% PROC_DRAWEX(0,DIST%(A%)):PROC_SCORE(150):PROC_SWITCH(A%):ENDPROC
3580 IF PULSE% PROC_DRAWPULSE(0,DIST%(A%)):PROC_SCORE(200):PROC_SWITCH(A%):ENDP
ROC
3590 PROC_DRAWSKWIG(0,DIST%(A%)):PROC_SCORE(300):PROC_SWITCH(A%)
3600 ENDPROC
```

```
3610 DEFPROC_SCORE(S%)
3620 SCORE%=SCORE%+S%
3630 COLOUR 2
3640 PRINT TAB(30,2);SCORE%
3650 ENDPROC
3660 DEFPROC_SWITCH(N%)
3670 DIST%(N%)=0:TUBE%(N%)=-1:GOT%=GOT%+1
3680 ENDPROC
3690 DEFPROC_NEWPOS
3700 LOCAL Q%
3710 Q%=0:REPEAT
3720   PLACE%=Q%:Q%=Q%+1
3730   UNTIL BLAST%(PLACE%) OR Q%>11
3740 IF Q%>12 PLACE%=RND(12)-1
3750 PROC_DRAWPLACE(2):FALL%=0
3760 ENDPROC
3770 DEFPROC_HISCORE
3780 *FX15,0
3790 IF SCORE%>HI% HI%=SCORE%
3800 FOR A%=2 TO 3
3810   PRINTTAB(0,A%)CHR$132;CHR$157;CHR$141;CHR$131;TAB(4,A%);"Your score was
";SCORE%
3820   PRINTTAB(13,A%+7);CHR$141;CHR$131;"Hi-Score";TAB(12,A%+10);CHR$133;CHR$1
41;"**";CHR$136;HI%;CHR$137;"**"
3830   NEXT
3840 PROC_VARIABLES2
3850 SCREEN%=0:LIFE%=3:NUM%=0:SCORE%=0
3860 PRINTTAB(2,20)CHR$130;"Press SPACE bar for another game...."
3870 REPEAT UNTIL GET=32
3880 ENDPROC
3890 *FX 9,25
3900 *FX 10,25
3910 MODE7
3920 REPORT:PRINT" at line ";ERL
```

Ace Avoider

by John Sinyard

'Avoider' is an action game for an unexpanded Jupiter Ace.

The idea is to control your craft (0) to intercept the Jewelites (*). Watch out, though, for the mutant asteroids (it's one of those months . . .) which will destroy your craft on impact (X = mutant asteroid).

If you capture all the Jewelites, or are killed, you move onto the next wave. Each wave is denser than the previous one.

You control your craft using the direction keys (5-8). The author's high score in FAST mode is 142 in wave 14.

Comments must be omitted when typing in the program on an unexpanded Ace.

```
( all numbers are in decimal )
DECIMAL

CREATE MC                        ( - )
                                 ( machine code routines for
                                   scrolling the screen excluding
                                   the top line                    )
 17 C, 9951 ,     ( LD DE 9951 )       ( scroll right routine )
 33 C, 9950 ,     ( LD HL 9950 )
  1 C,  672 ,     ( LD BC 672  )
237 C,  184 C,    ( LDDR       )
253 C,  233 C,    ( JP(IY)     )
 17 C, 9951 ,     ( LD DE 9951 )       ( scroll down routine  )
 33 C, 9919 ,     ( LD HL 9919 )
  1 C,  672 ,     ( LD BC 672  )
237 C,  184 C,    ( LDDR       )
253 C,  233 C,    ( JP(IY)     )
 17 C, 9280 ,     ( LD DE 9280 )       ( scroll left routine  )
 33 C, 9281 ,     ( LD HL 9281 )
  1 C,  672 ,     ( LD BC 672  )
237 C,  176 C,    ( LDIR       )
253 C,  233 C,    ( JP(IY)     )
 17 C, 9280 ,     ( LD DE 9280 )       ( scroll up routine    )
 33 C, 9312 ,     ( LD HL 9312 )
  1 C,  672 ,     ( LD BC 672  )
237 C,  176 C,    ( LDIR       )
253 C,  233 C,    ( JP(IY)     )

0 VARIABLE S                     ( score                           )
0 VARIABLE W                     ( wave                            )
0 VARIABLE SD                    ( used for generating random
                                   numbers                         )
```

PROGRAMS

```
0 VARIABLE P                 ( crafts position in screen
                               memory                       )
: RP                         ( charactor - )
                             ( pokes a jewelite/prang randomly
                               on to the screen             )
 BEGIN
  474                        ( number of available positions  )
  SD @ 75 U* 75 0 D+         (
  OVER OVER U< - - 1-          RND as in the manual
  DUP SD ! U* SWAP DROP                                     )
  9280 + DUP C@ 32 >         ( forms random address and checks
 WHILE                         that it is not poking onto already
  DROP                         exsisting jewelite/prang/craft  )
 REPEAT
 C!
;

: D?                         ( direction - )
                             ( advances craft in direction
                               only if within the borders of
                               the screen                   )
 DUP P @ + DUP P !           ( forms new address and stores it
 DUP 9312 < OVER               in P, then checks if it is within
 9919 > OR OVER 32 MOD         the borders of the screen    )
 DUP 0= SWAP 31 = OR OR
 IF
  - ABS P !                  ( if on borders then restore
 ELSE                          original value to P          )
  DROP DROP                  ( else retain new value of P   )
 THEN
;

: S?                         ( charactor - )
                             ( if craft has encountered a
                               jewelite ( 42 = ASCII of * , the
                               jewelite ) then increment score
                               and clear that place on screen  )
 42 =
 IF
  S @ 1+ S ! 32 P @ C!
 THEN
;
: K?                         ( - )
                             ( checks if a direction key has
                               been pressed, and if so then
                               sends direction vector to D? for
                               validation checks             )
 INKEY ?DUP
 IF
  DUP 53 =
  IF
   -1 D?                     ( left  )
  THEN
  DUP 54 =
  IF
   -32 D?                    ( Up    )
  THEN
  DUP 55 =
  IF
   32 D?                     ( down  )
  THEN
  56 =
  IF
   1 D?                      ( right )
```

PROGRAMS

```
 THEN
ELSE
 20 10 BEEP               ( balances the time delay of key
THEN                        checks if no key has been
;                           pressed                         )
: MV                      ( - )
                          ( initiates the screen : then
                            prints the status, controls the
                            scrolling of the screen, checks
                            for collisions with craft : until
                            all jewelites are taken or
                            collision with a prang          )
BEGIN
 CLS S @ -1               ( stacks initial score and starts
                            a counter                       )
 79 9584 DUP P ! C!       ( resets craft into centre of the
                            screen                          )
 W @ 1+ DUP W !           ( wave number ( * 2 ) determines
 2 * 0                      the density of the clouds       )
 DO
  88 RP 42 RP             ( 88 = ASCII of X , the prangs
 LOOP                       42 = ASCII of * , the jewelites )
 100 2000 BEEP            ( GET READY ! )
 BEGIN
  9216 15388 !            ( this is faster than 0 0 AT      )
  ." SCORE= " S @ .
  ."  LIVES= " I' .       ( I' fetches the loop counter of
  ."  WAVE= " W @ .         the 'lives' DO-LOOP within RUN
                            from the return stack underneath
                            the return address for RUN      )
  32 P @ C!               ( enables movement of craft/screen)
  K?
  P @ C@ DUP 88 =         ( collision of craft with a prang
  IF                        causes return to RUN so
   EXIT                     decrementing the 'lives' loop
  THEN                      counter, second C@ used by S? ,
  S?                        else dropped on return to RUN   )
  1+                      ( increment the counter           )
  DUP 24 MOD 6 /          ( equation for deriving from the
  13 * MC + CALL            counter the order in which the
                            machine code screen scrolling
                            routines are called, producing
                            a 6x6 square of rotation        )
  P @ C@ DUP 88 =         (
  IF
   EXIT                     same as before
  THEN
  S?                                                        )
  79 P @ C! 20 5 BEEP     ( pokes the craft onto the screen,
                            79 = ASCII of O , the craft, the
                            beep provides a delay before it
                            is cleared                      )
  OVER DUP                ( initial score to top of stack   )
  S @ = 0=                ( 1 flag if initial and new scores
                            are different                   )
  SWAP S @ - W @          ( 1 flag if wave*2 modulus of
  2 * MOD 0=                jewelites eaten this wave =0    )
  AND                     ( all jewelites must be eaten to
 UNTIL                      procede                         )
 DROP DROP                ( drops initial score and counter )
 50 1000 BEEP 0           ( WELL DONE ! )
UNTIL
;
: RUN                     ( - )
```

```
                         ( the word to run the complete
                           game                          )
0 S ! 0 W !
0 5
DO                       ( the 'lives' DO-LOOP           )
 MV
 DROP DROP DROP          ( drop the C@, counter and initial
 207 P @ C!                score stacked within MV       )
 500 2000 BEEP -1        ( OOPS ! )
+LOOP
700 2000 BEEP            ( OH DEAR ! )
```

BBC RAM Editor

by T Allchin

'RAM Editor' is a utility for a BBC or Electron.

Last month, we published BBC 'Sected' — a program allowing users to examine and modify the contents of a disk. 'RAM Editor' performs a similar job for RAM.

The main use of the program is to recover programs which have become partially corrupted — perhaps through saving without verifying. Often, when you get a 'Bad program' message on loading, there is very little you can do about it, except attempt to load the program again.

RAM Editor allows you to search through RAM for the corrupted section and correct it manually, thus allowing the program to be run.

The program displays the contents of a specified memory location, together with the seven following locations. The display is divided into three columns: the address itself (in hex), the contents of the address in hex, and the contents of the address in ASCII form.

The commands available <c>hange a byte, <j>ump to a new location and <e>xit 'RAM Editor'.

To select the precise byte you want to modify, either <j>ump to it or use the cursor keys if the byte is currently displayed on the screen. Before pressing 'c' to <c>hange the byte, use the TAB key to toggle between ASCII and hexadecimal mode.

To change a byte in hexadecimal mode, press 'c' followed by a two-digit hex value. To change a byte in ASCII mode, press 'c' followed by the character to be written to the location.

<J>ump is used to move to a new memory location. Simply enter a decimal number when presented with the 'type new address' prompt.

<E>xit is used to delete 'RAM Editor' from memory, leaving the original (or modified) program intact. The escape key must *not* be used to exit the program as it may corrupt the program.

If you have an Epson printer, one final command not shown on the display is <D>ump. As you would expect, this dumps a screen image to the printer.

The program is 2.3k long, and uses local variables wherever possible to avoid conflict with the program to be modified. As listed below, it runs in mode 6 to allow compatibility with the Electron. I would suggest, however, that BBC users adapt the program to run in mode 7. This uses less memory and thus leaves room for larger programs to be dealt with.

It is obviously necessary to ensure that 'RAM Editor' and the program to be acted on are kept in different areas of memory. The easiest approach is to place 'RAM Editor' above the program you want to play with. To do this, load the program first. Enter 'P. TOP' as a direct command and note the value. Then set PAGE to a higher value.

If there is insufficient memory on a disk-based system, save both 'RAM Editor' and your own program to tape, and use the disk workspace. To do this, load your own program from tape and then set PAGE to &E00. Then load 'RAM Editor' from tape in the following format: LOAD "EDITOR" E00 (assuming that you saved 'RAM Editor' to tape using the filename EDITOR).

Enter END as a direct command, and then RUN.

```
L.
   10REM MEMORY VIEW
   20REM BY T ALLCHIN
   30REM COPYRIGHT 1984
   40MODE6
   50M=PAGE:C=6:tab%=0:*FX4,1
   60PROCscreen
   70PROCarea
   80PROCmove
   90GOTO60
  100CLS:PRINT" BYE,BYE":*FX4,0
  110END
  120DEFPROCscreen
  130LOCAL X,A
  140IFtab%=0THEN tab$=" ASCII"ELSE tab$="   HEX"
  150PRINTTAB(0,0)"ADDRESS     HEXADECIMAL          ASCII";
  160PRINTTAB(0,1)
  170FORX=M TO M+124 STEP8
```

PROGRAMS

```
180PRINTTAB(0);~X;TAB(7);
190D$=""
200FORY=0TO7
210A=X?Y
220IFA<16THENPRINT"0";~A;" ";ELSE PRINT;~A;" ";
230IFA>31ANDA<128THENB$=CHR$(A) ELSEB$="."
240D$=D$+B$
250NEXT
260PRINTD$;
270NEXT
280PRINTTAB(C,10);">";TAB((C+3),10);"<";
290mem=(M+64+((C/3)-2))
300PRINTTAB(0,19)"MEMORY ADDRESS  ASCII  MEMORY AREA";';TAB(1)"DEC    HEX";
320PRINTTAB(0,23);STRING$(34,"=");tab$;
330PRINTTAB(0,24);"E=END  C=CHANGE  J=JUMP  ";
340ENDPROC
350DEFPROCmove
360LOCAL A,K
370mem=(M+64+((C/3)-2))
380PRINTTAB(0,21);mem;TAB(7,21)~mem;
390A=?mem
400IFA>31ANDA<128THENPRINTTAB(18,21);CHR$(A)ELSEPRINTTAB(18,21);"."
410PRINTTAB(24,24);:K=GET
420IFK=138THEN M=M+8:GOTO60
430IFK=139THEN M=M-8:GOTO60
440IFK=136ANDC>6THENPRINTTAB(C,10);" ";TAB((C+3),10);" ";:C=C-3:PRINTTAB(C,10)
;">";TAB((C+3),10);"<";:PROCmove
450IFK=137ANDC<26THENPRINTTAB(C,10);" ";TAB((C+3),10);" ";:C=C+3:PRINTTAB(C,10
;">";TAB((C+3),10);"<";:PROCmove
460IFK=67THEN PROCchange
470IFK=74THEN PROCjump
480IFK=69THEN100
490IFK=68THEN PROCdump
500IFK=9THENtab%=NOT(tab%):GOTO60
510GOTO80
520ENDPROC
530DEFPROCjump
535PRINTTAB(0,24)STRING$(12," ");
540PRINTTAB(0,24);M;:INPUTTAB(11,24);"TYPE NEW ADDRESS",M
550CLS
560GOTO60
570ENDPROC
580DEFPROCarea
590LOCAL X
600X=1
610RESTORE
620REPEAT
630READNUM
640READAREA$
650IFmem<NUM THENPRINTTAB(24,21)AREA$;:X=2
660UNTILX=2
670ENDPROC
680DEFPROCchange
690LOCAL NUM,X,CH
700PRINTTAB(0,24)"   TYPE NEW CHARACTER  ";
710IFtab%=0THEN CH=GET:PRINTCHR$(CH);:?mem=CH:GOTO60
720X=0
730REPEAT
740CH=GET:PRINTCHR$(CH);:CH=CH-48
750IFCH>22THENPRINTTAB(0,24)"ERROR PLEASE RE-ENTER ";:GOTO720
760IFCH>10THENCH=CH-7
770IFX=0THENNUM=CH*16:GOTO790
780NUM=NUM+CH
790X=X+1
800UNTILX=2
810?mem=NUM:GOTO60
820ENDPROC
830DATA256,"ZERO PAGE      ",512,"6502 STACK     ",786,"OPS WORKSPACE "
840DATA1024,"MISC WORKSPACE",2048,"ROM WORKSPACE ",2304,"MISC WORKSPACE"
850DATA2816,"VAR. BUFFERS  ",3072,"FUN. KEY DEFS.",3328,"CHARACTER DEF."
860DATA3584,"USER ROUTINES ",32768,"USER RAM AREA ",49152,"LANG. ROM AREA"
870DATA64512,"OPS SYS ROM    ",65280,"MEMORY MAPPING",65535,"OPS SYS ROM    "
880DEFPROCdump
890COLOUR2
900LOCAL X,Y
910FORY=0TO24
920FORX=0TO39
930VDU2:PRINT FNDUMP(X,Y);
940NEXT:PRINT:NEXT:VDU3
950COLOUR3
960GOTO60
970ENDPROC
980DEF FNDUMP(X,Y)
990LOCALA%,LX,LY,C
1000LX=POS
1010LV=VPOS
1020VDU31,X,Y
1030A%=135
1040C=USR(&FFF4)
1050C=C AND&FFFF
1060C=C DIV&100
1070VDU31,LX,LY
1080=CHR$(C)
```

```
ADDRESS     HEXADECIMAL

1900   0D 00 0A 11 F4 20 4D 45 ..... ME
1908   4D 4F 52 59 20 56 49 45 MORY VIE
1910   57 0D 00 14 12 F4 20 42 W..... B
1918   59 20 54 20 41 4C 4C 43 Y T ALLC
1920   48 49 4E 0D 00 1E 14 F4 HIN.....
1928   20 43 4F 50 59 52 49 47  COPYRIG
1930   48 54 20 31 39 38 34 0D HT 1984.
1938   00 28 06 EB 36 0D 00 32 .(..6..2
1940  >19<4D 3D 90 3A 43 3D 36 .M=.:C=6
1948   3A 74 61 62 25 3D 30 3A :tab%=0:
1950   2A 46 58 34 2C 31 0D 00 *FX4,1..
1958   3C 0B F2 73 63 72 65 65 <..scree
1960   6E 0D 00 46 09 F2 61 72 n..F..ar
1968   65 61 0D 00 50 09 F2 6D ea..P..m
1970   6F 76 65 0D 00 5A 09 E5 ove..Z..
1978   8D 54 7C 40 0D 00 64 19 .T|@..d.

MEMORY ADDRESS  ASCII  MEMORY AREA
 DEC    HEX
6464   1940       .      USER RAM AREA

================================ ASCII
E=END  C=CHANGE  J=JUMP
```

PROGRAMS

Sirius Grafkeys
by Barbara Binless

'Grafkeys' is a simple utility to aid Sirius programmers.

The program allows the function keys and numeric keypad to be redefined to contain Sirius graphics characters. Since key pads may be defined in unshifted, shifted and ALTered modes, a total of 75 characters can be made available. This facilitates the easy entry of graphics characters in PRINT statements, and so on, making the program easier to read than a mass of PRINT CHR$s.

The program is self-explanatory. All REM statements may be safely omitted; lines have been broken up neatly using CTRL-J, but may be entered as one long line. The program will run under CP/M-86 or MS-DOS.

```
1 ' Key definition program  Version 2.2
2 '
3 '     This program allows the user to enter ASCII graphics
        characters direct from the keyboard,
4 '     the upper ASCII characters are displayed
        and can be assigned to the function keys and to
5 '     the keys in the numeric keypad.
        One character can be assigned to each key in normal,
6 '     shifted and alternate modes, giving a total of 75 extra characters.
17 '
18 ' Common initialization block
19 '
20      DEF FNC$(ROW%,COL%)=ESC$+"Y"+CHR$(31+ROW%)+CHR$(31+COL%) :
        DEF FNRAND(X%)=INT(RND(1)*X%+1)
30      DEF FNCENTRE$(ROW%,T$)=FNC$(ROW%,40-LEN(T$)\2)+T$ :
        DEF FNUP$(X$)=CHR$(ASC(X$)+32*(ASC(X$)>96))
40      ESC$=CHR$(27) : CLS$=ESC$+"E" : EREOL$=ESC$+"K" : EREOF$=ESC$+"J" :
        ERBOL$=ESC$+"o" : ERBOF$=ESC$+"b"
50      HION$=ESC$+"(" : HIOFF$=ESC$+")" : REVON$=ESC$+"p" : REVOFF$=ESC$+"q" :
        UNDON$=ESC$+"0" : UNDOFF$=ESC$+"1"
60      CURON$=ESC$+"y5" : CUROFF$=ESC$+"x5" : CURSAV$=ESC$+"j" :
        CURBAK$=ESC$+"k" : BELL$=CHR$(7)
70      LINON$=CURSAV$+ESC$+"x1"+FNC$(25,1) : LINOFF$=ESC$+"y1"+CURBAK$ :
        BLINKON$=ESC$+"2" : BLINKOFF$=ESC$+"3"
80      CLRALL$=ESC$+"z" : YES%=-1 : NO%=0 : WIDTH 255
96 '
97 ' Display program name and characters 128 to 254.  Characters below 128 may
98 ' also be used by entering their ASCII code
99 '
100     PRINT CLS$ REVON$ FNCENTRE$(1," GRAPHICS KEY DEFINITION ") REVOFF$ : PRINT
110     FOR I%=128 TO 254 : PRINT I% CHR$(I%) "  "; : NEXT : PRINT
120     FINISHED%=NO% : PRINT FNC$(17,5) "Press return to leave unchanged:"
127 '
128 ' Get first key to change
129 '
130     READ KEY$,KEY% : IF KEY$="" AND KEY%=0 THEN FINISHED%=YES%
140     WHILE NOT FINISHED%
147 '
148 ' Change key definitions as required
149 '
150             PRINT FNC$(19,5) KEY$ FNC$(19,20) EREOL$; : INPUT "Unshifted";X%
160             IF X%=0 THEN 200
170                     PRINT FNC$(19,45) CHR$(X%); : INPUT "  OK";ANS$
180                     IF ANS$<>"" THEN IF FNUP$(ANS$)<>"Y" THEN 150
190                     PRINT ESC$ "41" CHR$(KEY%) CHR$(X%)
200             PRINT FNC$(20,20) EREOL$; : INPUT "Shifted";X%
210             IF X%=0 THEN 250
220                     PRINT FNC$(20,45) CHR$(X%); : INPUT "  OK";ANS$
230                     IF ANS$<>"" THEN IF FNUP$(ANS$)<>"Y" THEN 200
240                     PRINT ESC$ "42" CHR$(KEY%) CHR$(X%)
250             PRINT FNC$(21,20) EREOL$; : INPUT "Alternate";X%
260             IF X%=0 THEN 300
270                     PRINT FNC$(21,45) CHR$(X%); : INPUT "  OK";ANS$
280                     IF ANS$<>"" THEN IF FNUP$(ANS$)<>"Y" THEN 250
290                     PRINT ESC$ "43" CHR$(KEY%) CHR$(X%)
300             PRINT FNC$(18,1) EREOF$
307 '
308 ' Get next key and test for end of data
309 '
310             READ KEY$,KEY%
320             IF KEY$="" AND KEY%=0 THEN FINISHED%=YES%
330       WEND : PRINT CLS$ : END
9995 '
9996 ' Following data is for numeric pad keys and function keys [1] to [7],
9997 ' however any of the keys may be redefined.  Data required for each key
9998 ' is "Key.top.label", logical.key.number.  End list with "",0
9999 '
10000 DATA "calc",28,"%",29,"div",30,"x",31
10010 DATA "7",49,"8",50,"9",51,"-",52
10020 DATA "4",69,"5",70,"6",71,"+",72
10030 DATA "1",90,"2",91,"3",92,"enter",93
10040 DATA "0",100,".",102
10050 DATA "[1]",1,"[2]",2,"[3]",3,"[4]",4,"[5]",5,"[6]",6,"[7]",7
10060 DATA "",0
```

Spectrum Supalanda
by Michael Housley

'Supalanda' is a game of the 'moon-lander' variety. It requires a 48k Spec-

trum, and can be controlled using either the keyboard or a Kempston joystick.

The object is to land your space-craft on one of the landing pads, the harder-harder-to-reach pads being worth more points. To land on one of the pads, you have to dodge the asteroids and guide your craft down the canyons.

There are four levels, each more difficult than the last. At the start of each screen the space-craft appears at the top with the prompt 'Ready'. To begin, press any key or the joystick fire button. Left to its own devices, the ship will slowly sink downwards. To move left or right, use the joystick or press Z and M respectively.

If you hit anything other than a landing-pad, your ship will be destroyed and you'll have to start again having lost a life. If you complete all four levels successfully, the game starts again but with more asteroids to avoid.

The score, high-score and remaining lives are displayed at the top of the screen.

```
   1 PAPER 0: BRIGHT 0: BORDER 0
 : RESTORE : LET hi=0: INK 7
   5 DATA BIN 00111100,BIN 01111
110,BIN 01011010,BIN 01011010,BI
N 01111110,BIN 00111100,BIN 0010
0100,BIN 01100110
  10 FOR f=0 TO 7: READ a: POKE
USR "a"+f,a: NEXT f
  15 DATA BIN 00111000,BIN 01111
100,BIN 00111111,BIN 11111111,BI
N 01111111,BIN 01111100,BIN 0011
1110,BIN 00011000
  20 FOR f=0 TO 7: READ a: POKE
USR "b"+f,a: NEXT f
  25 DATA 3,15,31,63,63,127,127,
255
  30 FOR f=0 TO 7: READ a: POKE
USR "c"+f,a: NEXT f
  35 DATA 192,240,248,252,252,25
4,254,255
  40 FOR f=0 TO 7: READ a: POKE
USR "d"+f,a: NEXT f
  45 DATA 255,254,254,252,252,24
8,240,192
  50 FOR f=0 TO 7: READ a: POKE
USR "e"+f,a: NEXT f
  55 DATA 255,127,127,63,63,31,1
5,3
  60 FOR f=0 TO 7: READ a: POKE
USR "f"+f,a: NEXT f
  65 DATA BIN 11111111,BIN 11111
111,BIN 01100110,BIN 01100110,BI
N 01100110,BIN 01100110,BIN 1111
1111,BIN 11111111
  70 FOR f=0 TO 7: READ a: POKE
USR "g"+f,a: NEXT f
 100 CLS : LET q=1
 101 FOR g=0 TO 21 STEP 21: FOR
f=0 TO 31: PRINT INK q;AT g,f;"
"
 102 LET q=q+1: IF q=8 THEN LET
q=1
 103 NEXT f: NEXT g
 105 FOR g=0 TO 31 STEP 31: FOR
f=0 TO 21: PRINT INK q;AT f,g;"
"
 106 LET q=q+1: IF q=8 THEN LET
q=1
 107 NEXT f: NEXT g
 110 PRINT INK 4;AT 2,7;"
 ";AT 3,7;"
 ";AT 4,7;"
"
 120 PRINT INK 7;AT 6,5;"Guide y
our spacecraft to";AT 7,3;"one o
f the landing pads at";AT 8,3;"t
he bottom of the screen."
 130 PRINT INK 7;AT 9,5;"Avoid t
he asteroids which";AT 10,3;"are
 scattered around the";AT 11,3;"
screen."
 132 PRINT INK 7;AT 12,5;"The sc
ore for landing is";AT 13,3;"giv
en at the side of each";AT 14,3;
"landing pad. The pads that";AT
15,3;"are harder to reach are ";
AT 16,3;"worth more points."
 134 PRINT INK 5;AT 18,3;"PRESS
ANY KEY TO CONTINUE"
 140 IF INKEY$="" THEN GO TO 140
 144 FOR f=6 TO 18: PRINT AT f,3
;"                              ":
```

PROGRAMS

```
NEXT f
 150 PRINT INK 7;AT 8,5;"J = KEM
PSTON JOYSTICK"
 155 PRINT INK 7;AT 11,9;"K = KE
YBOARD"
 160 PRINT INK 7;AT 14,5;"PRESS
J OR K TO START"
 165 IF INKEY$="j" THEN LET o$="
joy"
 170 IF INKEY$="j" THEN GO TO 18
5
 175 IF INKEY$="k" THEN LET o$="
key"
 180 IF INKEY$="k" THEN GO TO 18
5
 183 GO TO 165
 185 CLS
 186 LET lev=1: LET inc=-3: LET
m=1: LET sc=0: LET liv=5
 187 LET inc=inc+3
 188 IF lev=1 THEN GO TO 290
 190 IF lev=2 THEN GO TO 540
 192 IF lev=3 THEN GO TO 810
 194 IF lev=4 THEN GO TO 1100
 195 LET b=15
 196 FOR g=2 TO 21
 200 LET z=0
 205 IF INKEY$="m" THEN LET z=1
 207 IF INKEY$="z" THEN LET z=-1
 209 IF IN 31=2 THEN LET z=-1
 211 IF IN 31=1 THEN LET z=1
 215 IF b+z<0 THEN LET z=1
 220 IF b+z>31 THEN LET z=-1
 225 IF ATTR (g,b+z)=4 THEN GO T
O 2000
 230 IF ATTR (g,b+z)=15 THEN GO
TO 2000
 235 IF ATTR (g,b+z)=2 THEN GO T
O 276
 240 IF ATTR (g,b+z)=1 THEN GO T
O 2000
 245 PRINT INK 0;AT g+m,b;" "
 250 LET b=b+z
 255 PRINT INK 6;AT g,b;"■"
 260 IF INKEY$="m" OR INKEY$="z"
 THEN LET m=0
 265 IF INKEY$="m" OR INKEY$="z"
 THEN GO TO 200
 266 IF IN 31=2 OR IN 31=1 THEN
LET m=0
 267 IF IN 31=2 OR IN 31=1 THEN
GO TO 200
 270 LET m=-1
 275 NEXT g
 276 IF g=17 AND (b=14 OR b=15)
THEN LET sc=sc+100
 277 IF lev=2 AND (b=27 OR b=28)
 THEN LET sc=sc+200
 278 IF b=8 OR b=9 THEN LET sc=s
c+100
 279 IF lev=1 AND (b=27 OR b=28)
 THEN LET sc=sc+150
 280 IF lev=3 AND (b=14 OR b=15)
 THEN LET sc=sc+300
 281 IF b=1 OR b=2 THEN LET sc=s
c+100
 282 IF b=17 uR b=18 THEN LET sc
=sc+200
 283 IF g=21 AND (b=28 OR b=29)
THEN LET sc=sc+500
 234 BEEP .25,25
 285 FOR f=0 TO 100: NEXT f: LET
 lev=lev+1
 286 IF lev=5 THEN LET lev=1
 287 LET m=0: CLS
 288 IF lev=1 THEN GO TO 187
 289 GO TO 188
 290 PRINT INK 7;AT 0,0;"SCORE "
;sc;AT 0,11;"LIVES ";liv;AT 0,21
;"HIGH ";hi
 300 FOR f=0 TO 10+inc: BEEP .05
,-50: PRINT INK 4;AT RND*8+4,RND
*31;"●": NEXT f
 310 FOR f=15 TO 21: PRINT PAPER
 1;AT f,0;"
                ": NEXT f
 320 PRINT INK 1;AT 15,11;"▲"; I
NK 0;AT 15,12;"          ": INK 1;AT
```

```
 15,18;"◢"
 330 PRINT INK 1;AT 16,12;"◣"; I
NK 0;AT 16,13;"    "; INK 1;AT 1
5,17;"◢"
 333 FOR f=15 TO 19: PRINT AT f,
25;"    ": NEXT f: PRINT INK 1;A
T 15,24;"◣";AT 15,29;"◢": PRINT
INK 2;AT 20,27;"▥"; INK 7; PAPE
R 1;AT 21,26;"150"
 340 PRINT INK 2;AT 17,14;"▥";
INK 7; PAPER 1;AT 18,14;"100"
 350 LET b=15
 352 PRINT INK 7;AT 3,12;"READY
!"
 355 FOR f=1 TO 7
 360 PRINT INK f;AT 2,15;"♜"
 380 IF IN 31=16 OR INKEY$<>"" T
HEN GO TO 400
 390 PAUSE 10: NEXT f: GO TO 355
 400 PRINT AT 2,15;" ";AT 3,12;"
      "
 520 GO TO 195
 540 PRINT INK 7;AT 0,0;"SCORE "
;sc;AT 0,11;"LIVES ";liv;AT 0,22
;"HIGH ";hi
 550 FOR f=0 TO 10+inc: BEEP .05
,-50: PRINT INK 4;AT RND*4+4,RND
*31;"♣": NEXT f
 560 FOR f=12 TO 21: PRINT PAPER
 1;AT f,0;"
           ": NEXT f
 570 FOR f=12 TO 18: PRINT PAPER
 0;AT f,7;"      ": NEXT f
 580 PRINT INK 2;AT 19,8;"▥": P
RINT INK 1;AT 12,6;"◣";AT 12,11;
"◢"
 585 PRINT INK 7; PAPER 1;AT 20,
8;"100"
 586 FOR f=12 TO 15: PRINT AT f,
20;"   ": NEXT f: PRINT INK 1;AT
 12,19;"◣";AT 12,23;"◢"
 587 PRINT AT 15,20;"       ";A
T 16,20;"       ";AT 17,20;"
    ": PRINT PAPER 1; INK 0;A
T 15,28;"◣"; PAPER 0; INK 1;AT 1
3,25;"◣": PRINT INK 1;AT 14,23;"
◥"; PAPER 1; INK 0;AT 17,20;"◥"
 588 PRINT AT 18,26;"     ";AT 19,
26;"   ": PRINT INK 2;AT 20,27;"
▥"; INK 7; PAPER 1;AT 21,26;"20
0"
 590 PRINT INK 7;AT 3,12;"READY
!"
 592 FOR f=1 TO 7
 593 PRINT INK f;AT 2,15;"♜"
 595 IF IN 31=16 OR INKEY$<>"" T
HEN GO TO 605
 600 PAUSE 10: NEXT f: GO TO 592
 605 PRINT AT 2,15;" ";AT 3,12;"
      "
 610 GO TO 195
 810 PRINT INK 7;AT 0,0;"SCORE "
;sc;AT 0,11;"LIVES ";liv;AT 0,20
;"HIGH ";hi
 820 FOR f=0 TO 10+inc: BEEP .05
,-50: PRINT INK 4;AT RND*2+3,RND
*31;"♣": NEXT f
 830 FOR f=8 TO 21: PRINT PAPER
1;AT f,0;"
          ": NEXT f
 840 PRINT INK 1;AT 8,3;"◣";AT 8
,6;"◢": FOR f=8 TO 14: PRINT AT
f,4;"  ": NEXT f
 850 PRINT INK 1;AT 12,6;"◥"; PA
PER 1; INK 0;AT 14,4;"◥"
 860 PRINT AT 13,6;"
";AT 14,6;"          ": PRINT
PAPER 1; INK 0;AT 13,17;"◣"; PAP
ER 0; INK 1;AT 15,11;"◣"
 870 FOR f=15 TO 19: PRINT AT f,
12;"   ": NEXT f: PRINT INK 2
;AT 20,14;"▥"
 875 PRINT INK 7; PAPER 1;AT 20,
16;"300"
 880 FOR f=0 TO 3: BEEP .05,-50:
PRINT INK 4;AT RND*4+14,RND*5+1
2;"♣": NEXT f
 890 PRINT INK 7;AT 3,12;"READY
!"
```

PROGRAMS

```
 892 FOR f=1 TO 7
 894 PRINT INK f;AT 2,15;"☗"
 900 IF IN 31=16 OR INKEY$<>"" THEN GO TO 920
 910 PAUSE 10: NEXT f: GO TO 892
 920 PRINT AT 2,15;" ";AT 3,12;"       "
1000 GO TO 195
1100 PRINT INK 7;AT 0,0;"SCORE ";sc;AT 0,11;"LIVES ";liv;AT 0,20;"HIGH ";hi
1110 FOR f=4 TO 21: PRINT PAPER 1;AT f,0;"                                ": NEXT f
1120 FOR f=4 TO 20: PRINT AT f,1;"  ": NEXT f: PRINT INK 1;AT 4,0;"◣";AT 4,3;"◢";AT 6,0;"◥";AT 6,3;"◢"
1130 PRINT AT 6,3;"                 ";AT 7,3;"                 "
1140 PRINT AT 8,9;"   ";AT 9,9;"   ": PRINT INK 1;AT 8,8;"◣";AT 8,11;"◢";AT 9,8;"◤";AT 9,11;"◥"
1150 FOR f=10 TO 20: PRINT AT f,6;"        ": NEXT f: PRINT PAPER 1; INK 0;AT 10,6;"◢";AT 10,13;"◣"
1160 FOR f=1 TO 10: BEEP .05,-50: PRINT INK 4;AT RND*8+11,RND*7+6;"✱": NEXT f
1170 PRINT AT 19,14;"      ";AT 20,14;"      ": PRINT INK 1;AT 18,14;"◥"; INK 0; PAPER 1;AT 19,19;"◣"
1180 PRINT INK 0; PAPER 1;AT 6,17;"◣"; INK 1; PAPER 0;AT 8,15;"◣"
1190 FOR f=8 TO 14: PRINT AT f,16;"  ": NEXT f
1200 FOR f=10 TO 14: PRINT AT f,18;"          ": NEXT f
1210 PRINT INK 1;AT 9,18;"◥": PRINT PAPER 1; INK 0;AT 14,16;"◥"
1220 FOR f=4 TO 20: PRINT AT f,27;"   ": NEXT f: PRINT INK 1;AT 4,26;"◣";AT 4,30;"◢";AT 9,26;"◤";AT 15,26;"◣"
1230 FOR f=0 TO 6: BEEP .05,-50: PRINT INK 4;AT RND*4+10,RND*10+17;"✱": NEXT f
1240 FOR f=4 TO 18 STEP 3: BEEP .05,-50: PRINT INK 4;AT f,RND*2+27;"✱": NEXT f
1250 PRINT INK 2;AT 21,1;"▥▥▥";AT 21,17;"▥▥▥";AT 21,26;"▥▥▥"
1260 PRINT INK 7; PAPER 1;AT 21,3;"100";AT 21,19;"200";AT 21,25;"500"
1270 PRINT INK 7;AT 3,12;"READY "
1275 FOR f=1 TO 7
1277 PRINT INK f;AT 2,15;"☗"
1280 IF IN 31=16 OR INKEY$<>"" THEN GO TO 1295
1290 PAUSE 10: NEXT f: GO TO 1275
1295 PRINT AT 2,15;" ";AT 3,12;"       "
1300 GO TO 195
2000 BEEP .1,-50
2010 PRINT AT g-1,b;" ";AT g,b;" "
2014 LET liv=liv-1
2020 FOR g=1 TO 5: FOR f=0 TO 255 STEP 20: OUT 100,f: NEXT f: NEXT g
2025 IF liv=0 THEN GO TO 2500
2030 CLS : GO TO 188
2500 FOR f=0 TO -50 STEP -1
2510 BEEP .01,f
2520 NEXT f
2530 CLS
2540 IF sc<hi THEN GO TO 2600
2550 LET hi=sc
2560 LET n$="NEW HIGH SCORE"
2570 FOR f=9 TO 22: BEEP .01,f*2: PRINT INK 2; PAPER 7; FLASH 1;
```

PROGRAMS

```
AT 8,f;n$(f-8): PAUSE 20: NEXT f
2580 PAUSE 75: BEEP .1,20: PAUSE
 10: BEEP .1,20: BEEP .25,15
2590 PAUSE 5: BEEP .1,15: BEEP .
1,20: BEEP .1,20: BEEP .1,20: BE
EP .25,25
2600 PRINT INK 7;AT 12,9;"YOU SC
ORED ";sc
2610 FOR f=0 TO 300: NEXT f: GO
TO 100
```

RML 380Z Millipede
by K Bell, M Gilbert and D Richardson

'Millipede' is a standard version of the popular game. It runs on a 380Z with a hi-res graphics board under BASICSG2 — a common combination in schools.

The controls are Z = left, X = right and RETURN = fire.

```
10 REM *********************************
20 REM "MILLIPEDE" WRITTEN By
30 REM K.Bell,M.Gilbert & D.Richardson
40 REM
50 REM WRITTEN ON A 380z IN 32K
60 REM USES BASICSG2 AND NEEDS HI-RES
70 REM GRAPHICS BOARD
80 REM
90 REM CONTROLS
100 REM ========
110 REM Z-LEFT    X-RIGHT    <RETURN>-FIRE
120 REM *********************************
130 PUT31:CALL"RESOLUTION",0,2
140 DIM SQ(6),SQ$(6)
150 ON ERROR GOTO 200
160 OPEN#10,"HISCORES.MIL"
170 FORN=1TO5:INPUT#10,SQ(N):NEXTN:CLOSE#10
180 OPEN#10,"HINAMES.MIL"
190 FORN=1TO5:INPUT#10,SQ$(N):NEXTN:CLOSE#10
200 S1=160:S2=21:ZZ=1
210 EZ=-10
220 H=1
230 SM=1:MP=30
240 LI=3
250 E=10
260 CALL"RESOLUTION",0,2
270 CALL"DEFCHAR",9,255,255,255,255,255,255,255,25
5
280 RO$=CHR$(9)
290 DIM CX(300),CY(300)
300 CX=222:CY=161
310 CALL"DEFCHAR",8,28,60,126,255,255,124,36,54
320 RANDOMIZE
330 CO=2
340 PUT 31
350 CALL"RESOLUTION",0,2:CALL"CHARSIZE",2,2
360 CALL"COLOUR",0,2,2,2
370 CALL"FILL",-5,171,319,191,1
380 Y=173:X=70
390 C$="MILLIPEDE"
400 A=0
410 K1=0:K2=170
420 FOR F=1 TO LEN(C$)
430 FOR B=1 TO LEN(C$)-A
440 A$=MID$(C$,B,1)
450 CALL"STPLOT",X,Y,VARADR(A$),CO
460 X=X+20
470 NEXTB
480 A=A+1:X=70:CO=CO+1:IF CO>3 THEN CO=2:GOTO430
490 NEXTF
500 CALL"FILL",0,0,318,20,2
```

PROGRAMS

```
510 SC$="SCORE=":SH$="HI SCORE="
520 PLOT 43,5,STR$(SQ(1))
530 CALL"CHARSIZE",1,1
540 CALL"STPLOT",225,4,VARADR(SC$),3
550 CALL"STPLOT",100,4,VARADR(SH$),3
560 CALL"DEFCHAR",1,8,34,136,32,24,24,24,24
570 CALL"DEFCHAR",2,60,126,255,255,0,0,0,0
580 CALL"DEFCHAR",5,0,0,255,255,255,255,255,255
590 CALL"DEFCHAR",10,102,153,126,253,126,153,165,6
6
600 BA$=CHR$(5)
610 FOR DG=1 TO MP
620 P1=INT(RND(1)*31)*10
630 P2=INT(RND(1)*13)*10+40
640 P1$=CHR$(1):P2$=CHR$(2)
650 CALL"STPLOT",P1,P2,VARADR(P2$),1
660 CALL"STPLOT",P1,P2,VARADR(P1$),3
670 NEXT
680 PLOT 64,56,"SHEET="+STR$(ZZ)
690 CALL"DEFCHAR",3,0,0,0,0,24,60,126,219
700 CALL"COLOUR",2,0,5,0
710 SP$=CHR$(3)
720 CALL"CHARSIZE",1,2
730 CALL"FILL",0,0,50,20,2:BB=1:CC=1
740 IF LI=1 THEN 790
750 FOR EP=1 TO LI-1
760 CALL"STPLOT",BB,CC,VARADR(SP$),3
770 BB=BB+9
780 NEXTEP
790 CALL"CHARSIZE",1,2
800 CALL"RDOUT",S1+2,S2,VARADR(B1):CALL"RDOUT",S1+
10,S2,VARADR(B2):IF B1<>0 OR B2<>0 THEN GOTO 1780
810 CALL"STPLOT",S1,S2,VARADR(SP$),3
820 IF KL=1 THEN GOTO  1020 ELSE GOSUB 930
830 G=GET(H)
840 IFG=13 THEN1360
850 IF G=90 ANDS1>10 THEN CALL"STPLOT",S1,S2,VARAD
R(SP$),0:S1=S1-10
860 IF G=88 AND S1<310THEN CALL"STPLOT",S1,S2,VARA
DR(SP$),0:S1=S1+10
870 IF G=27 THEN END
880 IF LP=1 THEN 1560
890 SD=INT(RND(1)*10)+1
900 IF SD=5 THEN 1520
910 GOTO 790
920 REM
930 CP$=CHR$(8)
940 CALL"CHARSIZE",1,1
950 FOR A=1 TO E
960 CX(A)=220-A*10:CY(A)=150
970 CALL"STPLOT".CX(A),CY(A),VARADR(CP$),2
980 NEXTA
990 CALL"CHARSIZE",1,2
1000 KL=1
1010 RETURN
1020 CALL"CHARSIZE",1,1
1030 CX(A)=CX(A-1)+EZ:CY(A)=CY(A-1)
1040 IF CX(A)>310 OR CX(A)<0 THEN 1130
1050 CALL"RDOUT",CX(A)-4,CY(A),VARADR(ER)
1060 CALL"RDOUT",CX(A)+4,CY(A),VARADR(ES)
1070 IF ER=3OR ES=3THEN GOTO1130
1080 CALL"STPLOT",CX(A),CY(A),VARADR(CP$),2
1090 CALL"STPLOT",CX(A-E),CY(A-E),VARADR(RO$),0
1100 CALL"CHARSIZE",1,2
1110 A=A+1
1120 GOTO 830
1130 CALL"CHARSIZE",1,1:CX(A)=CX(A)-EZ
1140 CY(A)=CY(A-1)-10
1150 CALL"STPLOT",CX(A),CY(A),VARADR(CP$),2
1160 CALL"STPLOT",CX(A-E),CY(A-E),VARADR(RO$),0
1170 A=A+1
1180 EZ=-1*EZ
```

```
1190 CX(A)=CX(A-1)+EZ:CY(A)=CY(A-1)
1200 CALL"STPLOT",CX(A),CY(A),VARADR(CP$),2
1210 CALL"STPLOT",CX(A-E),CY(A-E),VARADR(RO$),0
1220 CALL"CHARSIZE",1,2
1230 A=A+1
1240 GOTO 830
1250 REM CRASH
1260 IF SC=0 THEN SC=100
1270 I2=150:LP=0
1280 IF E=1 THEN 1980
1290 FOR XX=1 TO 60
1300 RANDOMIZE
1310 CALL"COLOUR",0,(RND(1)*7),(RND(1)*7),(RND(1)*
3)
1320 NEXTXX
1330 FOR XX=1 TO 700:NEXTXX
1340 LI=LI-1:IF LI=0 THEN 1780
1350 GOTO 350
1360 FOR AB =42 TO 164 STEP 10
1370 CALL"RDOUT",S1+4,AB,VARADR(FG)
1380 IF FG<>0 THEN CALL"PLOT",S1+3,S2+8:CALL"LINE"
,S1+3,AB,3
1390 IF FG<>0 THEN CALL"STPLOT",S1,AB-4,VARADR(BA$
),0
1400 IF FG<>0 THEN CALL"PLOT",S1+3,S2+8,0:CALL"LIN
E",S1+3,AB,0
1410 IF E<1 THEN 1980
1420 IF S1=CX(A) THEN SC=SC+500:MP=MP+5:GOTO 1650
1430 IF FG=2 THEN 1660
1440 IF FG=1 THEN SC=SC+100:LP=0:I2=160:GOTO 1500
1450 IF FG<>0 THEN PLOT 69,5,STR$(SC):GOTO 790
1460 NEXT AB
1470 IF SC>10000 AND EL=0 THEN LI=LI+1:EL=1:GOTO 7
30
1480 IF SC>20000 AND EL=1 THEN LI=LI+1:EL=2:GOTO 7
30
1490 IFFG=0THENCALL"PLOT",S1+3,S2+8,3:CALL"LINE",S
1+3,AB,3:CALL"PLOT",S1+3,S2+8,0:CALL"LINE",S1+3,AB
,0
1500 PLOT 69,5,STR$(SC)
1510 GOTO 790
1520 REM
1530 SD$=CHR$(10)
1540 I1=INT(RND(1)*29)*10
1550 I2=150
1560 CALL"CHARSIZE",1,1
1570 CALL"STPLOT",I1,I2+10,VARADR(RO$),0
1580 CALL"STPLOT",I1,I2,VARADR(SD$),1
1590 I2=I2-10
1600 LP=1
1610 IF I1=S1 AND I2<30 THEN 1250
1620 IF I2<30 THEN CALL"STPLOT",I1,I2+10,VARADR(RO
$),0
1630 IF I2<30 THEN I2=150:LP=0
1640 GOTO 790
1650 REM
1660 BE=CX(A-E):OB=CY(A-E)
1670 CALL"CHARSIZE",1,1
1680 PLOT69,5,STR$(SC)
1690 FOR FL=OB TO 31 STEP -10
1700 CALL"STPLOT",BE,FL+10,VARADR(RO$),0
1710 CALL"STPLOT",BE,FL,VARADR(CP$),2
1720 NEXTFL
1730 CALL"STPLOT",BE,FL+10,VARADR(RO$),0
1740 IF BE=S1 THEN GOTO 1250
1750 CALL"STPLOT",BE,FL,VARADR(RO$),0
1760 E=E-1:SC=SC+100
1770 GOTO 790
1780 CALL"COLOUR",0,2,2,2:CALL"CLEAR"
1790 CALL"CHARSIZE",1,1
1800 A$="YOU SCORED "+STR$(SC):CALL"STPLOT",100,18
```

MICROMART

PROGRAMS

```
0,VARADR(A$),1
1810 A$="GAME OVER"
1820 CALL"CHARSIZE",3,3:CALL"STPLOT",50,150,VARADR
(A$),3
1830 CALL"FILL",46,140,270,149,1
1840 CALL"CHARSIZE",1,1
1850 GOTO2160
1860 A$="DO YOU WANT ANOTHER GAME (Y/N)"
1870 CALL"STPLOT",40,10,VARADR(A$),3
1880 A$="HIGH SCORES":CALL"STPLOT",100,130,VARADR(
A$),2
1890 GX=30:GY=120
1900 FORN=1TO5
1910 IFLEN(SQ$(N))>20 THEN SQ$(N)=LEFT$(SQ$(N),20)
1920 A$=STR$(N)
1930 CALL"STPLOT",GX,GY,VARADR(A$),3:CALL"STPLOT",
GX+20,GY,VARADR(SQ$(N)),3:A$=STR$(SQ(N)):CALL"STPL
OT",GX+220,GY,VARADR(A$),3
1940 GY=GY-10:NEXTN
1950 G$=GET$()
1960 IF G$="N" OR G$="n" THEN END
1970 IF G$="Y" OR G$="y" THEN RUN ELSE 1950
1980 CALL"CLEAR"
1990 CALL"CHARSIZE",1,1
2000 M1=10:M2=100
2010 FOR AA=1 TO MP
2020 CALL"STPLOT",M1,M2,VARADR(P2$),1
2030 CALL"STPLOT",M1,M2,VARADR(P1$),3
2040 M1=M1+12
2050 IF M1>25*12 THEN M2=M2-10:M1=10
2060 NEXTAA
2070 A$="BONUS+"+STR$(MP*10)
2080 B$="SHEET NUMBER "+STR$(ZZ)
2090 CALL"CHARSIZE",2,2
2100 CALL"STPLOT",45,140,VARADR(B$),1:
2110 CALL"STPLOT",85,20,VARADR(A$),3
2120 SC=SC+MP*10
2130 FOR GG=1 TO 2000:NEXT
2140 MP=MP+5:ZZ=ZZ+1:E=10+ZZ
2150 GOTO 320
2160 REM HISCORE TABLE
2170 PUT31:?:?:?:?:?:?
2180 IFSC>SQ(5)THEN INPUT"WHAT IS YOUR NAME ":SQ$(
6):SQ(6)=SC ELSE 2220
2190 FORN=5TO1STEP-1
2200 IF SQ(N+1)>SQ(N) THEN SS=SQ(N):CL$=SQ$(N):SQ(
N)=SQ(N+1):SQ$(N)=SQ$(N+1):SQ(N+1)=SS:SQ$(N+1)=CL$
2210 NEXTN
2220 PUT 31
2230 IF LOOKUP("HISCORES.MIL")=0 THEN 2250
2240 ERASE "HISCORES.MIL":ERASE"HINAMES.MIL"
2250 ON ERROR GOTO 1860
2260 CREATE#10,"HISCORES.MIL":FORN=1TO5:PRINT#10,S
Q(N):NEXTN:CLOSE#10
2270 CREATE#10,"HINAMES.MIL":FORN=1TO5:PRINT#10,SQ
$(N):NEXTN:CLOSE#10
2280 GOTO 1860
```

VIC Hatchery

by Bryn Phillips

'The Hatchery' is a program along the lines of BugBytes' Panic — though with a totally different plot. It will run on an unexpanded machine.

The scenario is as follows. As chief designer of a new micro which only works with a ROM hanging onto the back of the cartridge port, you have been transferred to other duties on a little-known planet inhabited by giant hens (don't ask, just don't ask . . .).

Scientists have built giant hatcheries in an attempt to hatch some eggs, and you have been assigned to guarding them. All seems well until you receive a message that a hatchery has been overrun by telepathic monsters (I told you not to ask). Your instructions are clear: destroy the remaining eggs before they, too, can hatch into some-

thing large, telepathic and unfriendly.

Only . . . you hear a cracking sound. One of the eggs is hatching! And that's where the game begins. You have to smash the eggs. As you do so, however, fragments of the shell recombine to form new eggs which in turn start to hatch. The monsters are lethal if you come into contact with them, and more than ten of them will destroy you with their combined telepathic powers. (Well, I suppose Pacman is pretty silly if you actually think about it.)

The game has nine levels of difficulty ranging from 1 (simple) to 9 (forget it). You move along the levels using '.' (full stop) for left and '/' for right. You can also use 'S' and 'X' to move up and down ladders. Alternatively, you can use a joystick. To smash an egg (where have I heard that before?), simply run into it — not subtle, but effective.

You have three lives. Uncracked eggs are worth one point each, cracked eggs two points and open eggs three points. At the end of the game, press the space bar to play again.

The listing is in two parts; the first should be saved directly before the second. When you run program one, the second program will be loaded automatically.

PROGRAM 1

```
 10 PRINT"THE HATCHERY"
 20 PRINT"USE THE JOYSTICK OR   KEYS . / S AND X TO   MOVE MAN AND SMASH
EGGS."
 30 PRINT"YOU LOSE A LIFE IF     YOU RUN INTO A         MONSTER OR 10"
 40 PRINT"MONSTERS HATCH"
 50 PRINT"PLEASE WAIT"
 100 POKE 52,28:POKE56,28:CLR
 110 FOR I=7168TO7679:POKEI,PEEK(I+25600):NEXT
 120 FORC=7448TO7543:READA:POKEC,A:NEXT
 130 POKE36869,255
 140 DATA255,255,255,255,255,255,255,255,255,129,129,129,255,129,129,129
 150 DATA60,66,129,129,129,129,66,60,60,90,145,137,133,137,70,60
 160 DATA0,66,195,165,149,137,70,60,90,60,60,219,189,165,153,66
 170 DATA0,0,0,0,8,36,26,169,48,50,38,58,32,80,72,108
 180 DATA176,53,162,48,42,84,73,108,24,24,72,120,72,20,20,50
 190 DATA24,89,138,25,168,85,52,178,255,153,139,189,255,151,161,161
 200 PRINT"TO LOAD THE NEXT PART PLEASE PRESS RETURN"
 210 PRINT"LOAD"
READY.
```

PROGRAM 2

```
5 POKE36869,255
10 DIMJS(2,2):POKE37139,0:DD=37154:PA=37137:PB=37152
20 FORI=0TO2:FORJ=0TO2:READJS(J,I):NEXTJ,I
30 DATA-23,-22,-21,-1,0,1,21,22,23
200 POKE36879,25:PRINT""
210 GOSUB300:GOSUB310:GOSUB300:GOSUB330:GOSUB340:GOSUB350:GOSUB330
220 GOSUB360:GOSUB370:GOSUB330:GOSUB340:GOSUB350:GOSUB330:GOSUB310
230 GOSUB300:GOSUB300:GOSUB380
240 GOTO400
300 PRINT"$    $    $    $    $ $":RETURN
310 PRINT"$###$###$###$###$#$":RETURN
330 PRINT"$ $ $ $ $ $ $ $ $ $":RETURN
340 PRINT"$#$###$###$###$###$":RETURN
350 PRINT"$ $    $    $    $    $":RETURN
360 PRINT"$###$#$#$#$#$###$#$":RETURN
370 PRINT"$    $ $ $ $ $    $ $":RETURN
380 PRINT"#####################":RETURN
400 DIME%(9,5)
410 P1=8143:P2=38863:LV=3
411 PRINT"DIFFICULTY 1 TO 9"
412 GETD$:D=VAL(D$):IFD<1ORD>9THEN411
413 D=10-D
414 PRINT"                    "
415 PRINT"**"
420 FORC=1TO9:FORA=1TO5
430 POKEP1+(C*2)-22*(3*A-2),37:POKEP2+(C*2)-22*(3*A-2),2
440 NEXTA:NEXTC
450 X=1:Y=1:L=36:M1=42:X1=1:Y1=1:C1=0
455 FORC=1TO9:FORA=1TO5:E%(C,A)=37:NEXT:NEXT
460 POKE8122,42:POKE38842,0:POKE650,128
470 GET A$:GOSUB3000
472 IFN>9THEN2000
475 GOSUB1000
477 IFA$=""THEN470
480 LK=P1+X1-22*Y1
490 IFA$="/"AND(PEEK(LK+23)=35ORPEEK(LK+23)=36)THENX=X+1:GOTO600
500 IFA$="."AND(PEEK(LK+21)=35ORPEEK(LK+21)=36)THENX=X-1:GOTO650
510 IFA$="X"ANDPEEK(LK+22)=36THENY=Y-1:M1=46:GOTO700
520 IFA$="S"ANDPEEK(LK-22)=36THENY=Y+1:M1=46:GOTO700
590 POKE36878,5:GOTO470
600 IFPEEK(LK+1)=32ORPEEK(LK+1)=36THENM1=42:GOTO700
610 IFPEEK(LK+1)=40THEN2000
620 GOSUB1500:E%(X/2,(Y+2)/3)=36:M1=43:L2=41:GOTO700
650 IFPEEK(LK-1)=32ORPEEK(LK-1)=36THENM1=44:GOTO700
660 IFPEEK(LK-1)=40THEN2000
670 GOSUB1500:E%(X/2,(Y+2)/3)=36:M1=45:L2=41
700 POKEP1+X1-22*Y1,L:POKEP2+X1-22*Y1,C1
710 L=PEEK(P1+X-22*Y):C1=PEEK(P2+X-22*Y)
720 IFL2=41THENL=41:L2=0
750 POKEP1+X-22*Y,M1:POKEP2+X-22*Y,0
760 X1=X:Y1=Y
770 GOTO470
1000 R=INT(RND(1)*D):IFR<>0THEN1110
1005 C=INT(RND(1)*9)+1:A=INT(RND(1)*5)+1
1010 IFX1=A*2ANDY1=C*3-2THEN1000
1040 IFE%(C,A)=41THENE%(C,A)=37:GOTO1100
1050 IFE%(C,A)=40THEN1100
1055 IFE%(C,A)=39THENGOSUB2600
1060 E%(C,A)=E%(C,A)+1
1100 POKEP1+(C*2)-22*(3*A-2),E%(C,A):POKEP2+(C*2)-22*(3*A-2),2
1105 IFE%(C,A)=40THENPOKEP2+(C*2)-22*(3*A-2),5
1110 RETURN
1500 IFE%(X/2,(Y+2)/3)=41THEN1520
1510 SC=SC+E%(X/2,(Y+2)/3)-36
1520 PRINT"SC      "SC;TAB(10)"HG "H
```

```
1530 RETURN
2000 POKEP1+X1-22*Y1,L:POKEP2+X1-22*Y1,C1:LV=LV-1:GOSUB2500:N=0
2005 PRINT""TAB(4-LV)" ":IFLV=0THEN2100
2010 GOTO420
2100 PRINT"GAME OVER          "
2110 GETA$:IFA$<>" "THEN2110
2120 IFH<SCTHENH=SC
2130 PRINT"                   "
2140 PRINT"                   "
2150 SC=0:GOTO410
2500 POKE36878,15
2510 FORI=200TO170STEP-1:POKE36874,I:FORJ=1TO30:NEXT:NEXT
2520 POKE36874,0:POKE36878,0
2530 RETURN
2600 POKE36878,15
2610 FORI=128TO255STEP5:POKE36877,I:FORJ=1TO2:NEXT:NEXT
2620 POKE36878,0:POKE36877,0:N=N+1
2630 RETURN
3000 POKEDD,127:S3=-((PEEK(PB)AND128)=0):POKEDD,255
3010 P=PEEK(PA):S1=-((PAND8)=0):S2=((PAND16)=0):S0=((PAND4)=0)
3020 IFS0<>0THENA$="S"
3030 IFS1<>0THENA$="X"
3040 IFS2<>0THENA$="."
3050 IFS3<>0THENA$="/"
3060 RETURN
```

MZ-80K Frequency test

by Martin Aspinall

'Frequency test' is a useful program for hi-fi enthusiasts and audio-technicians. It assists in carrying out frequency response tests by prompting for output readings at different frequencies, and producing a graph of the results.

The printout provides a convenient permanent record of the test. Instructions are given within the program.

```
                                                3 2 2 2 2 2 1 1 1 1 1         X         1
Freq.     Output mV.   Ratio in dB.     - 0 8 6 4 2 0 8 6 4 2 0 8 6 4 2 0 2 4 6 8 0 +
-----------------------------------------------------------------------------------------
20HZ        50           -7                                          *
50HZ        75           -3.48                                          *
100HZ       100          -0.98                                            *
250HZ       125           0.95                                              *
500HZ       110          -0.16                                             *
1KHZ        105          -0.56                                            *
2KHZ        130           1.29                                              *
3KHZ        130           1.29                                              *
4KHZ        130           1.29                                              *
5KHZ        135           1.62                                               *
6KHZ        137           1.75                                               *
7KHZ        139           1.88                                               *
8KHZ        140           1.94                                               *
9KHZ        100          -0.98                                            *
10KHZ       90           -1.9                                            *
12KHZ       85           -2.4                                           *
14KHZ       83           -2.6                                           *
16KHZ       78           -3.14                                         *
18KHZ       73           -3.72                                         *
20KHZ       58           -5.72                                       *

-----------------------------------------------------------------------0-----------------

5 REM*RESPONSE M.S.ASPINALL 1/8/1983*
10 DIMA(20),B(20),S$(5)
40 FORI=1TO5:S$(I)="?":NEXTI
50 D$="?"
60 PRINT"TAPE RECORDER TEST PROGRAM."
70 PRINT"M.S.ASPINALL AUGUST 1983."
80 PRINT"-------------------------"
90 PRINT"Are you familiar with the use"
100 PRINT"of this program Y/N ?"
110 REM****SKIP TO INSTRUCTIONS****
120 GETU$:IFU$=""THEN120
130 IFU$="Y"THEN160
140 IFU$="N"THEN950
150 GOTO120
160 PRINT"Enter date e.g 26/7/83."
170 INPUT"";D$
180 PRINT"Do you wish to include details of"
190 PRINT"machine and customer etc. Y/N ?"
200 GETU$:IFU$=""THEN200
210 IFU$="Y"THEN240
220 IFU$="N"THEN350
230 GOTO200
240 PRINT"Please answer following questions."
250 INPUT"Make of machine:   ";S$(1)
260 INPUT"Model of machine:  ";S$(2)
270 INPUT"S/N. of machine:   ";S$(3)
280 INPUT"Type of tape used: ";S$(4)
290 INPUT"Customer name:     ";S$(5)
300 PRINT"ARE ABOVE DETAILS CORRECT Y/N ?"
310 GETU$:IFU$=""THEN310
320 IFU$="Y"THEN350
330 IFU$="N"THEN240
340 GOTO310
350 RESTORE
360 X=0
370 Y=0
380 PRINT"Enter output at 1kHz. reference in mV.------"
390 PRINT"----------"
400 INPUT"";Y
410 PRINT"Enter output level in mV.------"
420 FORX=1TO20
430 READX$
440 PRINT"AT ";X$
450 INPUT"";A(X)
460 IFA(X)<1THEN450
470 B(X)=INT(LOG(A(X)/Y)*20*10↑2+0.5)/10↑2
480 PRINTTAB(25);"";B(X);TAB(32);"dB."
490 NEXTX
```

```
500 RESTORE
510 PRINT"■Freq.     Output mV.  Ratio in dB."
520 PRINT"-----------------------------------"
530 FORX=1TO20
540 READX$
550 PRINTX$,A(X),"    ";B(X)
560 NEXTX
570 PRINT"1=Print out results. 2=Run test again."
580 PRINT"3=Test diff. machine. 4=End program."
590 GETZ:IF(Z<1)+(Z>4)THEN590
600 ONZGOTO610,350,10,1410
610 PRINT"■■■■■■■■IS THE PRINTER SET UP CORRECTLY Y/N"
620 GETU$:IFU$=""THEN620
630 IFU$="Y"THEN660
640 IFU$="N"THEN500
650 GOTO620
660 PRINT/PTAB(8);"=================================";
670 PRINT/P"=========================="
680 PRINT/PTAB(9);"Hi Fi TAPE RECORDER FREQUENCY RESPONSE CHECK DATE: ";D$
690 PRINT/PTAB(8);"===========================";
700 PRINT/P"===========================":PRINT/P:PRINT/P:PRINT/P
710 PRINT/P"Make: ";S$(1);TAB(30);"Model: ";S$(2);TAB(60);"S/N: ";S$(3)
720 PRINT/P:PRINT/P
730 PRINT/P"     Type of tape used: ";S$(4);TAB(50);"Customer: ";S$(5)
740 PRINT/P:PRINT/P:PRINT/P
750 PRINT/PTAB(37);"3 2 2 2 2 2 1 1 1 1 1          X          1"
760 PRINT/P"Freq.     Output mV.  Ratio in dB.";
770 PRINT/P"  - 0 8 6 4 2 0 8 6 4 2 0 8 6 4 2 0 2 4 6 8 0 +"
780 PRINT/P"-------------------------------------------";
790 PRINT/P"-------------------------------------------"
800 RESTORE
810 FORX=1TO20
820 READX$
830 PRINT/PX$,A(X),"    ";B(X);TAB(INT(B(X)+67.4));"*"
840 NEXTX
850 PRINT/P:PRINT/P"--------------------------------------------";
860 PRINT/P"--------------------------0-------------"
870 PRINT/P:PRINT/P"M.S.ASPINALL. 1/8/1983."
880 PRINT/P"***********************"
890 GOTO500
900 DATA20HZ,50HZ,100HZ,250HZ,500HZ
910 DATA1KHZ,2KHZ,3KHZ,4KHZ,5KHZ
920 DATA6KHZ,7KHZ,8KHZ,9KHZ,10KHZ
930 DATA12KHZ,14KHZ,16KHZ,18KHZ,20KHZ
950 PRINT"■The purpose of this program is to help"
960 PRINT"an audio technician in evaluating"
970 PRINT"a HiFi tape recorder frequency response"
980 PRINT"  When used correctly it will print a"
990 PRINT"neat table of results suitable to"
1000 PRINT"present to a client,or for your own use"
1010 PRINT" It is essential that you have an audio"
1020 PRINT"signal generator and millivolt meter."
1030 PRINT" Before carrying out a full test it is"
1040 PRINT"advisable to check the performance with"
1050 PRINT"the tape being used at 1KHZ and 10KHZ."
1060 PRINT"  This will give some indication of the"
1070 PRINT"suitability of the tape,and if the bias"
1080 PRINT"needs adjustment. This can be achieved"
1090 PRINT"by recording a signal at 1KHZ and 10KHZ"
1100 PRINT"at -20dB from 0VU,and comparing the"
1110 PRINT"levels on playback. The two levels"
1120 PRINT"must be within a few mV if the machine"
1130 PRINT"is to be regarded as HiFi. If not then"
1140 PRINT"the bias may need adjustment. Once this"
1150 PRINT"has been achieved a full test may be"
1160 PRINT"carried out."
1170 PRINT"■■■■■■■■■■■■PRESS CR TO CONTINUE"
1180 GETU$:IFU$=""THEN1180
1190 PRINT"■You will be given the option to"
1200 PRINT"include in the printout,details of the"
1210 PRINT"machine make and model etc. If this is"
1220 PRINT"is not required then press N. Next you"
1230 PRINT"enter the reference output at 1KHZ."
1240 PRINT"Once this is done you will be promted"
1250 PRINT"for the levels measured at different"
1260 PRINT"frequencies starting at 20HZ. A table"
1270 PRINT"of results will then be given with a"
1280 PRINT"small menu at the bottom. The menu"
1290 PRINT"should be self explanatory. Please"
1300 PRINT"press CR after answering each promt."
1310 PRINT"The frequencies to record are:"
1320 PRINT"■20HZ, 50HZ, 100HZ, 250HZ, 500HZ,1KHZ,"
1330 PRINT"2KHZ, 3KHZ, 4KHZ, 5KHZ, 6KHZ, 7KHZ,"
1340 PRINT"8KHZ, 9KHZ, 10KHZ, 12KHZ, 14KHZ, 16KHZ"
1350 PRINT"18KHZ, 20KHZ."
1360 PRINT"■■■■1=Start test. 2=Repeat instructions."
1370 GETU$:IFU$=""THEN1370
1380 IFU$="1"THEN160
1390 IFU$="2"THEN950
1400 GOTO1370
1410 END
```

Spectrum Bigprint

by Andrew Allan

'Bigprint' is a short and useful routine to display double-height characters.

Three variables must be defined either before the routine is called, or at the beginning of the routine (line 119, for example). These are n$, 1 and c. The variable n$ contains the string to be displayed, 1 the line number and c the column number. The character set which can be displayed in this way is shown above the listing.

```
The following characters may be
doubled in height:

!"#$%&'()*+,-./0123456789:;<=>?@
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑_£
abcdefghijklmnopqrstuvwxyz{|}~©

This is what they look like when
```

PROGRAMS

```
doubled:

 !"#%&'()*+,-./0123456789:;<=>?@
 ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]↑_
 £abcdefghijklmnopqrstuvwxyz{|}©

The following strings/variables
must be defined in order to make
the program work:
n$ This is the string you wish
   to print in double height
l  The line at which it is to
   be printed
c  The column at which it is to
   be printed

Here is a listing of the program

  100>REM ************************
  105 REM *    Double height     *
  110 REM * © 1984 Andrew Allan  *
  115 REM ************************
  120 LET b=0: DIM a(8): FOR d=1
TO LEN n$: LET n=CODE n$(d TO d)
  125 FOR x=1 TO 8: LET a(x)=PEEK
 (15615+8*(n-32)+x): NEXT x
  130 FOR f=0 TO 7 STEP 2: LET b=
b+1: POKE USR "a"+f,a(b): POKE U
SR "a"+(f+1),a(b): NEXT f
  135 FOR f=0 TO 7 STEP 2: LET b=
b+1: POKE USR "b"+f,a(b): POKE U
SR "b"+(f+1),a(b): NEXT f
  140 LET c=c+1: LET b=0: PRINT A
T l,c;CHR$ 144: PRINT AT l+1,c;C
HR$ 145: NEXT d
```

Tape-to-disk
by Damian Manning

'Tape-to-disk' is a utility program for a disk-based BBC system.

Adapting cassette-based programs to run on disk systems can be a time-consuming task. This program is designed to ease the task of relocating the program.

The program assumes that you know the load and execution addresses, and the length of the program; these should be entered when prompted. When prompted for the assemble address, &900 or &7B00 are likely bets.

The program is not for beginners — you have to know what you are doing — but does cut down the amount of work involved.

```
L.
  10MODE7:VDU23;8202;0;0;0;
  20DIM CLI 32,hex$(4),add$(2)
  30PROCinstr
  40PROCinit
  50PROCinput
  60PROCassemble
  70PROCsave
  80PROCend
  90PROCwindow(0,24,39,2)
 100CLS:PRINT'''''':PROCcentre("f5Program terminated")
 110END
 120REM  ************************
 130REM  ** Start of procedures **
 140REM  ************************
 150DEFPROCinput
 160REM *FX21,0 Flushes keyboard buffer
 170*FX21,0
 180CLS
 190PROCcentre("f3Input assemble address in hex")
 200P%=FNhex:A$=input$
 210PROCwindow(1,17,39,16)
 220CLS
 230PRINT"f3Assemble add. = &";A$
 240PROCwindow(0,10,39,7)
 250CLS
 260PROCcentre("f3Do you want the object file")
 270PROCcentre("f3to *LOAD another program")
 280PROCcentre("f3(Y/N)")
 290*FX21,0
 300PROCanswer("YyNn")
 310IF INSTR("Nn",G$) THEN 600
 320CLS
 330PROCcentre("f3Type in the program name leave a space")
```

```
340PROCcentre("f3then input the load address please")
350*FX21,0
360PROCcentre("f5"):INPUTname$:load=TRUE
370b=19:c=18
380PROCwindow(1,b,39,c)
390CLS
400PRINT"f3*Loading       = ";name$
410PROCwindow(0,10,39,7)
420CLS
430*FX21,0
440PROCcentre("f3Is the program Basic")
450PROCcentre("f3(Y/N)")
460PROCanswer("YyNn")
470IF INSTR("Nn",G$)THEN490
480basic=TRUE:GOTO600
490CLS
500PROCcentre("f3Do you want it executed")
510PROCcentre("f3(Y/N)")
520PROCanswer("YyNn")
530IF INSTR("Nn",G$) THEN 600
540mcode=TRUE
550CLS
560PROCcentre("f3Please enter the execution")
570PROCcentre("f3address of the TAPE program")
580*FX21,0
590E%=FNhex:PROCcentre("f5"):E$=input$
600CLS
610PROCcentre("f3Do you want the object file to select")
620PROCcentre("f3the tape filing system")
630PROCcentre("f3(Y/N)")
640*FX21,0
650PROCanswer("YyNn")
660IF INSTR("Nn",G$)THEN680
670tape=TRUE
680CLS
690PROCcentre("f3Do you want it to change PAGE")
700*FX21,0
710PROCcentre("f3(Y/N)")
720PROCanswer("YyNn")
730IF INSTR("Nn",G$)THEN840
740*FX21,0
750CLS
760PROCcentre("f3Input page value please")
770Page%=FNhex
780P$=input$:page=TRUE
790b=b+2:c=c+2
800PROCwindow(1,b,39,c)
810CLS
820PRINT"f3Page value     = &";P$
830PROCwindow(0,10,39,7)
840CLS
850PROCcentre("f2Enter the memory shift details")
860*FX21,0
870PROCwindow(0,11,39,9)
880CLS
890PROCcentre("f3Input move from address")
900MF%=FNhex
910*FX21,0
920CLS
930PROCcentre("f3Input move to address")
940MT%=FNhex
950*FX21,0
960CLS
970PROCcentre("f3Input length of program")
980LB%=FNhex:LB%=LB%+MF%:LB%=LB%+1
990PROCwindow(0,10,39,7)
1000ENDPROC
1010REM*****************************
1020REM** START OF MACHINE CODE **
1030REM*****************************
1040
1050DEFPROCassemble
1060load%=P%
1070IF load THEN PROCpoke("*L.",P%):PROCpoke(name$,P%-1)
1080tape%=P%
1090IF tape THEN PROCpoke("*T.",P%)
1100page%=P%
1110IF page THEN PROCpoke("PA.=&",P%):PROCpoke(P$,P%-1)
1120?P%=0:PF%=P%+1
1130 FOR opt=0 TO 2 STEP 2:P%=PF%
1140[OPT opt
1150.start           OPT FNLoad
1160                 OPT FNTape
1170                 OPT FNPage
1180.over            LDX #LB% MOD 256
1190.from            LDA MF%
1200.to              STA MT%
1210.inc_lsb_from    INC from+1
1220.loop            BEQ inc_msb_from
1230.inc_lsb_to      INC to+1
1240                 BEQ inc_msb_to
1250                 JMP check
1260.inc_msb_from    INC from+2
1270                 BNE loop
1280.inc_msb_to      INC to+2
1290.check           LDA from+2
1300                 CMP  #LB% DIV 256
1310                 BNE from
1320                 CPX from+1
1330                 DEX
```

PROGRAMS

```
1340                BNE from
1350                JMP overtext
1360.pokecode       OPT FNBasic
1370                OPT FNMcode
1380.overtext       LDY pokecode
1390                CPY #&00
1400                BEQ end
1410                LDX #&00
1420                LDA #&8A
1430                JSR osbyte
1440                INC overtext+1
1450                BNE overtext
1460.end            RTS
1470]:NEXT
1480end%=P%
1490PROCdec_hex(end%)
1500b=b+2:c=c+2
1510PROCwindow(1,b,39,c)
1520PRINT"f1File end add. = &";add$(0)
1530PROCwindow(0,10,39,7)
1540ENDPROC
1550REM**********************************
1560REM** Hex input without "&"     **
1570REM**********************************
1580DEF FNhex
1590PROCcentre("f5"):INPUT input$
1600IF input$="" :VDU11,13:GOTO1590
1610FORloop=0TOLEN(input$):IF INSTR("0123456789ABCDEF",
    MID$(input$,loop,1))THEN
    NEXT ELSE PRINTTAB(13)"f1f8INPUT ERRORf9":
    T=TIME:REPEAT UNTIL TIME=T+300:VDU11,
13:PRINTSPC(38):VDU11,11,13:PRINTSPC(38):VDU11,13:GOTO1590
1620answer%=EVAL("&"+input$)
1630=answer%
1640REM**********************************
1650REM** Wait for Test$ to be input *
1660REM**********************************
1670DEFPROCanswer(Test$)
1680G$=GET$:IF INSTR(Test$,G$) THEN ENDPROC ELSE VDU13:GOTO1680
1690ENDPROC
1700
1710DEFPROCpoke(text$,add%):L%=LEN(text$)
1720$add%=text$:add%=add%+L%:?add%=&0D:P%=add%+1
1730ENDPROC
1740REM***************************
1750REM** Old & Run if basic  **
1760REM***************************
1770DEF FNBasic
1780IF basic THEN PROCpoke("O.",P%):PROCpoke
    ("RUN",P%):[OPT opt:]:?P%=0:P%=P%+1
1790=opt
1800REM********************************
1810REM** CALLexec.add. if m/code **
1820REM********************************
1830DEF FNMcode
1840IF mcode THEN PROCpoke("CALL&",P%):PROCpoke
    (E$,P%-1):[OPT opt:]:?P%=0:P%=P%
+1
1850=opt
1860REM********************************
1870REM** *LOAD option, sends the **
1880REM**      data to CLI.       **
1890REM********************************
1900DEF FNLoad
1910IF load [OPT opt:LDY #load% DIV 256:LDX #load%
     MOD 256:JSR oscli:]
1920=opt
1930REM***************************
1940REM** Select tape option **
1950REM***************************
1960DEF FNTape
1970IF tape [OPT opt:LDY #tape% DIV 256:LDX #tape%
     MOD 256:JSR oscli:]
1980=opt
1990REM***************************
2000REM** Change page option **
2010REM***************************
2020DEF FNPage
2030IF page [OPT opt:.loop LDY page%
     :CPY #0:BEQ over:LDX #0:LDA #&8A:JSR osbyte
:INC loop+1:BNE loop:]
2040=opt
2050REM********************************
2060REM** Start of *SAVE routine **
2070REM********************************
2080DEFPROCsave
2090CLS
2100PROCcentre("f6Do you wish to save the object code")
2110*FX21,0
2120PROCcentre("f6(Y/N)")
2130PROCanswer("YyNn")
2140IF INSTR("Nn",G$) THEN ENDPROC
2150*FX21,0
2160CLS
2170PROCcentre("f6Please type in the filename")
     :PRINT:PROCcentre("f5"):INPUTfil
e$
2180REM********************************
2190REM** Cut back filename to 7 **
2200REM** characters. Allow 9 if **
```

PROGRAMS

```
2210REM** dir. being used        **
2220REM*****************************
2230IF ASC(MID$(file$,2,1))=&2E THEN file$=CHR$
  (34)+LEFT$(file$,9)+CHR$(34):GOTO2260
2240file$=CHR$(34)+LEFT$(file$,7)+CHR$(34)
2250
2260B=B+1
2270PROCdec_hex(PF%)
2280$CLI="SAVE "+file$+" "+A$+" "+add$(0)+" "+add$(1)
2290X%=CLI MOD 256:Y%=CLI DIV 256
2300CALLoscli
2310REM*****************************
2320REM** Convert decimal to hex **
2330REM*****************************
2340DEFPROCdec_hex(decimal)
2350FOR loop=1TO4
2360num=(decimal MOD 16+1)
2370hex$(loop)=MID$(hc$,num,1)
2380decimal=decimal DIV 16
2390NEXT
2400add$(B)=hex$(4)+hex$(3)+hex$(2)+hex$(1)
2410ENDPROC
2420REM*****************************
2430REM** Start of instructions **
2440REM*****************************
2450DEFPROCinstr
2460FOR I%=0TO1:VDU&94,&9D,&81,&8D:PRINT"T A P E - D I S K":NEXT
2470PRINT'''''''TAB(10);:VDU&95,&9D,&84:PRINT"BY D.Manning";:VDU&9C
2480PRINTTAB(12);:VDU&95,&9D,&84:PRINT"(C) 1984   ";:VDU&9C
2490PROCDELAY(175)
2500PROCwindow(0,10,39,7)
2510*FX21,0
2520PRINT''
2530PROCcentre("f2Do you want instructions")
2540PROCcentre("f2(Y/N)")
2550PROCanswer("YyNn")
2560IF INSTR("Nn",G$) THEN ENDPROC
2570PROCwindow(0,24,39,2)
2580CLS:PRINT''"f6  This program was written to ease"'"f6the task
   of running tape based "'"f6software on a disk system.
   You will"'"f6be asked various questions and"'"f6prompted
   to input simple data "'"f6about the tape program"
 2590PROCDELAY(100)
 2600PRINT'"f6
   This program will then"'"f6generate and save a machine
   code"'"f6routine which you can use to"'"f6download
   and run your program
."
 2610PROCDELAY(150)
 2620PROCcontinue
 2630PRINT''"f6You will be asked to input the
    "'"f6assemble address of the objec
    t "'"f6program. This should be a location"'"f6that will
    not be used by the"'"f6t ape based program."
 2640PROCDELAY(100)
 2650PRINT'"f6     All numbers should be input"'"f6in hex,
    but the ";CHR$(34);"&
";CHR$(34);"f6ampersand"'"f6should not preceed the number"
 2660PROCDELAY(150)
 2670PROCcontinue
 2680PROCwindow(0,10,39,7):ENDPROC
 2690DEFPROCDELAY(T)
 2700UP=TIME+T:REPEAT UNTIL TIME=UP
 2710ENDPROC
 2720REM*************************
 2730REM** Wait for space bar**
 2740REM*************************
 2750DEFPROCcontinue
 2760*FX21,0
 2770PRINT'''':VDU&94,&9D,&81:PROCcentre
    ("Press thef3f8spacef7f1to continue  ")
 2780PROCanswer(" ")
 2790CLS
 2800ENDPROC
 2810REM*****************************
 2820REM** PRINTS TEXT IN CENTRE **
 2830REM*****************************
 2840DEFPROCcentre(t$)
 2850L%=40-LEN(t$)
 2860tab=(L%-1)/2
 2870PRINTTAB(tab);t$;
 2880ENDPROC
 2890DEFPROCwindow(A,B,C,D)
 2900VDU28,A,B,C,D
 2910ENDPROC
 2920DEFPROCend
 2930PRINT''
 2940PROCcentre("f5Do you want to generate more code")
 2950PROCcentre("f5(Y/N)")
 2960PROCanswer("YyNn")
 2970IF INSTR("Nn",G$) THEN ENDPROC
 2980GOTO40
 2990ENDPROC
 3000DEFPROCinit
 3010oscli=&FFF7:osbyte=&FFF4
 3020B=0:H$="":hc$="0123456789ABCDEF"
 3030load=FALSE:tape=FALSE:page=FALSE:basic=FALSE:mcode=FALSE
 3040ENDPROC
 3050REPORT
```

NEW

A4

Your own individual letterheading and continuous stationery in A4 size on top quality paper.

Artwork and design service available.

Ask for samples and prices

Reed Computers Ltd
Vale Road, Windsor SL4 5JL
Telephone: 075 35 59272

POSEIDON COMPUTER SERVICES LTD.

Of Hampton S.W. London Dealer
FOR SIRIUS 1 APRICOT & PULSAR

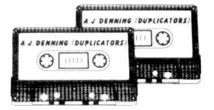
COMPETITIVE PRICES — FULL UK DELIVERY

Bespoke Software and Consultancy

01 941 1447/5986 TELEX 8954665 GITS

CIF I O FOB — *EXPORT/IMPORT SPECIALISTS FOR COMPUTER EQUIPMENT AND SOFTWARE*

POSEIDON COMPUTER SERVICES LTD
01 941 1447/5986 TELEX 8954665 GITS



A.J. DENNING (DUPLICATORS)

QUALITY CONTROLLED CASSETTE DUPLICATING
QUALITY & SERVICE AT COMPETITIVE RATES

QUALITY
Constant Stringent checks Made Throughout Production.

SERVICE
Despatched Normally Within 10 Days From Receipt Of Master.

PRICE
C10 From 28p Including Case.
C15 From 31p Including Case.

CONTACT US NOW FOR YOUR PERSONAL QUOTATION.

A.J. DENNING (DUPLICATORS)
19 The Crescent,
Henleaze,
Bristol.
BS9 4RW Tel (0272) 623267

COURSEWINNER

The Punters Computer Program

COURSEWINNER allows you to use the power of your computer to get the edge on the bookmaker.

- COURSEWINNER contains a database full of detailed information on all English and Scottish flat courses. The ten leading jockeys and trainers, and effect of the draw is detailed for each course.
This information can be displayed on the screen at any time.
- The program analyses these factors combined with the results of the last three outings, starting price and weight carried.
- COURSEWINNER is simple and quick to use, yet very powerful.
- Boxed with detailed instruction booklet.

Price £12.50 all inclusive IMMEDIATE DISPATCH (RETURN OF POST)

Available for:
SPECTRUM (48K), BBC (B), COMMODORE 64, DRAGON, APPLE II/IIe, ATARI (48K).

POOLSWINNER

The Ultimate Pools Prediction Program

- POOLSWINNER is the most sophisticated pools prediction aid ever produced. It comes complete with its own massive database.
- Can be used for Scoredraws, Draws, Aways and Homes.
- The database contains over 20 000 matches (10 years league football). It updates automatically as results come in.
- The precise prediction formula can be set by the user. This allows development of your own unique method.
- Package is complete with program, database and detailed instruction booklet.

Price £15.00 all inclusive IMMEDIATE DISPATCH (RETURN OF POST)

Available for: SPECTRUM (48K), ZX81 (16K), BBC (B), COMMODORE 64, DRAGON, APPLE II/IIe, ATARI (48K).

Available from dealers or direct (return of post) from:

VISA PHONE — **selec** SOFTWARE — Access PHONE

37 Councillor Lane, Cheadle, Cheshire. Phone: 061-428 7425

Work on your own where you're not alone

A place where you can set up alone or start a business or open a branch office and not have to worry about who answers the phone when you're out.

And the location gives swift access to M4/M3 motorways, the North Circular, the Underground, British Rail and Heathrow Airport in a leafy environment with the Thames nearby.

It's London without the hassle.

UNITS FROM 100 SQ.FT. AT £28 pw. INCLUSIVE

Call in, phone or write: **Barley Mow Workspace, 10 Barley Mow Passage, Chiswick, London W4 4PH. Telephone 01-994 6477.**

COMPUTERS

Spectrum 16K	£86.90	Commodore 64	£161.00
Spectrum 48K	£113.00	Electron	£173.80
Dragon 32	£145.00	B.B.C.B.	£346.95

Apple Computers available

PRINTERS

Alpha Com 32		Gemini 15X	£325.00
(for Spectrum)	£52.20	Delta 10	£325.00
Epson RX80 F/T	£230.00	Epson RX80	£205.00
Epson FX80	£330.00	Shinwa CP80 F/T	£225.00
Star Gemini 10X	£205.00	Printer Cable	£ 8.50

MONITORS 14" COLOUR

Cable £170.00 *Microvitic £173.00 *TV Monitor £200.00
All complete with lead Nomendy/Saba

CUMANA DISK DRIVES

SPECIAL PRICE 100K single without power supply £112
with power supply £145 200K double £260
Phone for price on other drives

ACCESSORIES

B.B.C. Disk Interface	£92.00
Upgrade A to B	£79.00
Spectrum 16K to 48K	£19.95
JOYSTICKS Quickshot 1	£7.20
Quickshot 2	£8
Sidewise Rom Board	£38.00
*27128 EPROMS	ring for price
*2764 EPROMS	ring for price
2271 Disk Controller	ring for price
Wordwise	£32.00

Large selection of software. Too many to list
Better price on any package supplied by newsagents

S.A.E. for software list. State make of machine.
£1.25 discount on two pro-rata for volumes over two.
Add 80 pence Post & Packing for small items and £8.00 for large items.
ADD 15% V.A.T. TO TOTAL

Leigh Computer Systems

36 Derby Road, Hinckley, Leicestershire LE10 1QF
Tel (0455) 612139

**Discounts on volume*

LOW LOW PRICES

DISK DRIVES (BBC Compatible)	
100K Single TEAC	£140
200K Single TEAC	£180
200K Dual TEAC	£275
800K Dual 40/80 TEAC	£450
800K Dual Mitsubishi 40/80	£400
MONITORS	
SANYO Hi-Res Green Screen	£89
SANYO Normal Res Green Screen	£69
MICROVITEC CUB 1431 RGB	£175
PRINTERS	
EPSON RX80T	£234
EPSON RX80FT	£261
JUKI 6100	£340
MT 80	£250

SPECIAL PACKAGE OFFERS ON SANYO, SIRIUS AND APRICOT COMPUTERS.

TELEPHONE OR WRITE FOR DETAILS AND FULL CATALOGUE.

All Prices Exclusive of VAT

Post & Packing: Securior £8, PO £4

Cheques/PO to:
SOUTH LINCS COMPUTERS
Old Mill House, Barnack
Lincolnshire PE9 3HA
Tel: 0780 56826

DISK OPERATING SYSTEM

for CBM 64

Commands include:

New Scratch
Rename Validate

£12.99 (P&P free)

St Albans Electronic Ltd
130 London Road
St Albans, HERTS
Tel: St Albans (0727) 56351

Programming the

PET/CBM

By Raeto West

The Reference Encyclopedia for Commodore PET and CBM Users

Comprehensive teaching and reference book on programming Commodore's 2000, 3000, 4000 and 8000 microcomputers and peripherals.

Many programs, charts and diagrams. 17 chapters, appendices, and index. iv + 504 page large-format paperback. ISBN 0 9507650 0 7. Price in UK and Europe £14.90 each (includes post and packing). Five or more £12.90 each. 48 hour order turnaround guaranteed.

From dealers and booksellers or direct:

Trade Manager, Edward Arnold (Publishers) Ltd, Woodlands Park Avenue, MAIDENHEAD, Berks SL3 3LX.
Tel: (062882) 3104

"A masterpiece" — *Creative Computing*
"Essential" — *Educational Computing*
"Excellent" — *Jim Strasma*
"Comprehensive & Accurate" — *Jim Butterfield*

Send orders and make cheques payable to:
Trade Manager, Edward Arnold (Publishers) Ltd,
Woodlands Park Avenue, MAIDENHEAD, Berks SL3 3LX.

Send .... copy/ies Programming the PET/CBM at £14.90
I enclose cheque/PO for £ ....
NAME ....
ADDRESS ....
....

BACK ISSUES SERVICE

Here is a guide to PCW back issues. Hardware reviews/Benchtests are indexed by manufacturer, software by product name.

HARDWARE

A

MANUFACTURER	PRODUCT	ISSUE
Acorn	Speech System	January 1984
Acorn	Electron	October 1983
Acorn	BBC Micro	January 1982
Acorn	Teletext Adaptor	April 1984
Acorn	BBC Speech Chips	April 1983
ACT	Apricot	October 1983
ACT	Sirius 1	February 1982
Adman Electronics	Adman Speech Synthesiser	January 1984
AGF	Programmable Joystick	December 1983
AMS	Disc Drive : 3in	January 1984
Apple	Lisa	July 1983
Apple	III	May 1982
Apple	Macintosh	March 1984

B

British Micro	Mimi 801	July 1982
Brother	EP44	April 1984

C

C/WP	Cortex	December 1983
Camputers	Lynx	March 1983
Canon	AS-100	December 1983
Canon	CX-1	November 1982
Canon	X-07	March 1984
Casio	PB-100	May 1983
Casio	fx-9000p	February 1983
Casio	602p	May 1982
Casio	FP-10 Printer	April 1982
Coleco	Adam	April 1984
Commodore	715	January 1984
Commodore	64	May 1983
Compudata	Tulipsystem 1	October 1983
Conchess	Monarch/Ambassador/ Escourter	March 1983
Corvus	Concept	March 1983
Currah	Microspeech Unit	January 1984

D

Dacom Systems	Buzzbox	January 1984
DCP Microdevelopments	Speech Pack	August 1982
Digihurst	Microsight 1	October 1983
Digital Equipment	Rainbow 100	November 1982
Dragon Data Ltd	Dragon 32	August 1982

E

Eaca International	Colour Genie	June 1983
Electroni-Kit	FX System	November 1983
Electroplay	My Talking Computer	November 1983
Epson	QX-10	July 1983
Epson	HX-20	December 1982
Epson	FX-80	July 1983
Epson	PX-8	June 1984

F

Ferranti	Argus PPC	November 1983
Fidelity	Prestige	February 1983
Fortune	Fortune 32:16	August 1983
Future	FX20	October 1983

G

Gavilan	Gavilan MC	February 1984
GCE	Vectrex System	August 1983
GCS	Ferrett	June 1984
Gemini	Multiboard	February 1982
GRiD	Compass	June 1984
Gulfstream	Hyperion	October 1983

H

Hewlett-Packard	HP-75C	November 1982
Hewlett-Packard	15C and 16C	September 1982
Hewlett-Packard	HP86	October 1982
Hewlett-Packard	HP-125	April 1982
Hewlett-Packard	HP-IL	March 1982
High Tech Electronics	Sid 1 Colour Board	April 1982
Hitachi	MB16001	June 1983
Hitachi	Peach	May 1982

I

IBM	9000 Instrumentation Computer	March 1983
IBM	PC Junior	March 1984
Ikon	Hobbit	January 1984
IO Research Ltd	Pluto	December 1982

J

Jonos	Jonos	April 1984
Jupiter Cantab	Ace	January 1983

L

LSI	M-Four	April 1983

M

Magus Computer Systems Ltd	Add-On Graphics Board	September 1983
Mannesmann Tally	MT160L Dot-Matrix Printer	August 1983
Mattel	Aquarius	November 1983
Microwriter Ltd	Microwriter	September 1982
Milton Bradley	Phantom	July 1983
Monroe	Monroe 8820	April 1982
Motorola	MC68000	December 1982
Multitech	Micro-Professor II	September 1983

N

NCR	Decision Mate V	August 1983
NEC	PC-8201A	December 1983
NEC	APC	September 1983
Notting Dale Itec	G007 Graphics Module	March 1983
Novag	Constellation	October 1983

O

Olivetti	M20	September 1982
Oric Products	Oric I	April 1983
Osborne	Executive	July 1983

P

Positron	9000	October 1982

R

Robocom Ltd	Bit Stik	November 1982

S

Sage	II	February 1983
Scisys	Chess Champion Mark 5	January 1983
Semi-Tech	Pied Piper	September 1983
Sharp	MZ-700	February 1984
Sharp	PC1251	February 1983
Sharp	PC1500	June 1982
Sharp	MZ-80A	June 1982
Sharp	MZ-80A	April 1984
Shelton Instruments	Sig/Net	April 1983
Sinclair	Microdrive	October 1983
Sinclair	ZX Spectrum	June 1982
Sinclair	ZX81 Printer	January 1982
SMT	Goupil-3	December 1983
Sord	M5	August 1983
Sord	Exleigh Expert	August 1982
Spectravideo	SV-318 and SV-328	March 1984

T

Tandata	Homedeck	April 1984

T

Tandy	MC-10	November 1983
Tandy	Model 100	August 1983
Texas Instruments	TI Professional	May 1983
Texas Instruments	TI-88	July 1982
Texas Instruments	TI-99/4A	March 1982
Texas Instruments	TI-59	January 1983
Torch Computers	Torch	January 1983
Tradecom	Newbrain AD	July 1982
Tycom	Microframe	January 1984

W X

Walters Microsystems	120 Printer	December 1982
Watanabe	Personal Plotter	February 1982
Wave Mate	Bullet	February 1984
William Stuart Systems	Chatterbox	January 1984
Wren Computers	Wren	April 1984
Xerox	16/8	February 1984
Xerox	820	January 1982

SOFTWARE

PROGRAM	ISSUE
1-2-3	April 1984
1-2-3	November 1983
1982 Database Roundup	December 1982
1983 Database Roundup	December 1983
1983 Spreadsheet Roundup	December 1983
A	
Accountancy Programs (General)	June 1983
Aquila	September 1982
B	
Benchmarks Explained (Reference Article)	January 1984
Beta	August 1983
Brainstorm	February 1984
Busifile	January 1984
Busipost	February 1983
C	
Cardbox	August 1982
Color Scarfman	December 1982
Condor Database	November 1982
D	
Databases (Choosing One)	March 1982
Dataplan	August 1983
Dataprism	March 1983
DBMS2	June 1982
Delta	October 1983
Desq	December 1983
DMS	March 1982
Dragon Disks	June 1984
E	
E40	September 1982
Ecalc	July 1983
Everyman	February 1984
Expert-Ease	June 1984
F	
Falc	January 1984
Financial Director	June 1983
FMS80	April 1982
Freqout	February 1982
H	
Homeword	February 1984
HP41-C Text Editor	November 1982
Home Accounts/Finance Manager	January 1984

Personal Computer World Specials: 1984 Microcomputer Benchtest Special: (£2.40 inc p&p) — 20 leading micros reviewed by the PCW team. Desktop Computing: (£2.25 inc p&p) — comprehensive guide to using micros in your business. Binders: (£3.95 each inc p&p) — keep your copies in order with these strong, attractive yellow binders.

PROGRAM	ISSUE
I L	
Information Management	April 1984
Infostar	September 1983
Lisawrite	August 1983
M	
Master Planner	April 1984
Master Planner	October 1983
Mathemagic/Graphmagic	August 1983
Micro FCS	October 1983
Micropen	May 1983
Microscript	May 1983
Microtax	July 1983
MS-DOS & CP/M-86	October 1982
MS-DOS 2	May 1983
Moneywise	June 1984
Multiplan	April 1983
O	
Omnis	July 1983
Open Access	June 1984
Optimum	November 1983
P	
Peachcalc	March 1984
Pearl	October 1982
Perfect Calc	October 1983
Personal Data Base	March 1984
Petspeed	April 1983
Plannercall	May 1983
Prophet II	March 1983
R	
Rescue	April 1983
Revelation	April 1984
S	
Sage 400 (Accounting)	October 1983
Scred	August 1983
Scripsit 2.0	February 1982
Search and Find	December 1983
Select	September 1982
Silicon Office	July 1982
System Builder	June 1984
Software Various	April 1984
Superdeflex	January 1983
Superfile	January 1983
T	
The Financial Planner	December 1983
The Spreadsheet	September 1983
TK! Solver	February 1984
Tomorrow's Office	June 1983
V	
View	August 1983
Visi On	November 1983
Visi Calc	June 1983
Visuall	February 1984
Vu-Calc (for Spectrum)	September 1983
W	
Word Handler II	March 1983
Word	June 1984
Wordspell	March 1984
Workslate	January 1984
dBase II	May 1982

Any one issue £1.50; all additional issues £1.00 each. Benchtest special £2.40. Desktop Computing £2.25. Binders £3.95 each. All prices include post and package. *Overseas orders requiring Air Mail postage add £1.00 per copy. Cheques/PO payable to Computing Publications Ltd, 53/55 Frith Street, London W1A 2HG. Please allow up to 3 weeks for delivery and don't forget to state your name and full address with your order. State clearly on a separate piece of paper the issue(s) you require and enclose a cheque/PO.

Name________________ Address________________

ANSWER BACK
SENIOR
QUIZ
GENERAL KNOWLEDGE

THE ULTIMATE EDUCATIONAL QUIZ FOR AGES 12 & OVER

BBC (32K)•ELECTRON

The ANSWER BACK Quiz provides an incredible adventure in education by combining a compelling Space-Age game with an immense series of questions on General Knowledge. The thought-provoking and well-researched quizzes contain an enormous total of 750 questions with 3000 answer options covering the following subjects:

□ Astronomy □ Music □ Natural History □ Famous People □ Science □ Sport □ History □ Art and Architecture □ Know your Language □ Discoveries and Inventions □ Legends and Mythology □ Geography □ Literature □ Films, TV and Theatre □ Pot Luck

The highly sophisticated control program rewards each correct answer with another turn in the colourful, animated game.

FEATURES INCLUDE

□ Multiple choice answers □ True or False? □ Find the missing letters □ "Pass" facility □ Immediate correction of errors □ Timer option □ Performance summary □ Re-run of questions passed or incorrectly answered □ Full facilities for creating and saving an unlimited number of new quizzes

Available from your computer store or by mail order Price £10.95.

AVAILABLE SHORTLY:
ANSWER BACK
Junior Quiz
for the under 11's

Other educational titles include...
'The French Mistress'
'The German Master'
'The Spanish Tutor'

The ANSWER BACK Senior Quiz will educate and fascinate ANYONE over 11 years old.

KOSMOS SOFTWARE, 1 Pilgrims Close, Harlington, DUNSTABLE, Beds. LU5 6LX
Please send me the ANSWER BACK Senior Quiz for the BBC/ELECTRON computer.
Mr/Mrs/Miss ....
Address ....
....
.... Post code ....
I enclose a cheque/postal order for £10.95 payable to KOSMOS Software

---

PHILIPS—12" TP200
12" Hi-resolution Mono-Monitor

£69.95 +VAT + £2.50 P&P

■ High Resolution Graphics
■ Trouble-Free Performance
■ Personal/Business use

HOT LINE ORDERS PHONE...
(0925) 602690/62907
Send cheque/P.Os to:
Advanced Memory Systems Ltd.
Green Lane, Appleton,
Warrington WA4 5NG

MULTI-USER WINCHESTER HARD DISK for COMMODORE MICROS

18 Mb nett, in 4 logical drives
36 Mb nett, in 8 logical drives
Up to 12 users
Specially designed for compatibility with the CBM 8000 series
300 systems + in daily use throughout Europe

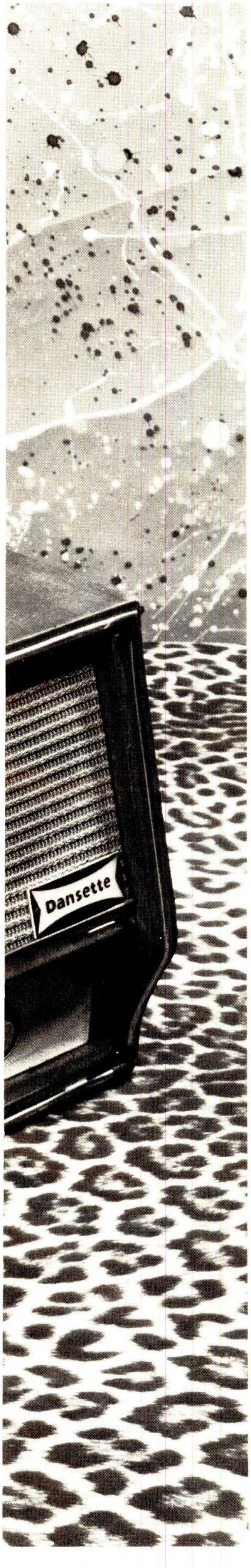
ADCOMP (UK) Ltd
56 Long Street, Dursley, Glos.
Tel: 0453 46496

adcomp

Amazing how played out some things

ecome.

Will you think the same of your micro in 6 months' time?



Remember the days when every record player was gifted with a needle instead of a stylus. 45's were "in," 78's were "out."

Before the days of hi-fi and laser discs. When a graphic equaliser was a break-through on the football pitch instead of in music technology.

Look at a record player now and it's a museum piece.

It's like that with micros too. The machine you thought would give endless hours of fun and interest often becomes a five minute wonder. Played out within months. Or so you thought.

But imagine communicating with other micro users on a nationwide mainframe system. Updating yourself daily with the very latest computer news and reviews. Paging a special Bulletin Board. Feasting from ™Prestel's vast menu. Even downloading a choice of software *absolutely free.*

In fact, imagine 30,000 pages at your fingertips and you've imagined what it's like to be on line with the Micronet 800 system.

For Just £13 a quarter (and, for most of you, a local telephone call whenever you want to connect up) you could subscribe to the Micronet system.

The only extra you need to connect up is a modem unit. Which is a small enough outlay for what it buys.

Micronet's features are almost limitless and constantly updating so why not see it in action at John Lewis stores, selected W. H. Smith shops and Spectrum UK dealers.

Or fill in the coupon for our brochure.

You'll find you won't want to play on anything else.

Please send me the full facts about Micronet 800.

Name ______________________

Make/Model of Micro ______________________

Address ______________________

____

____

Telephone ______________________

MICRONET 800, Durrant House, 8 Herbal Hill, London EC1R 5EJ. Telephone 01-278 3143 PCW/7/84

MICRONET 800, Durrant House, 8 Herbal Hill, London EC1R 5EJ. Telephone 01-278 3143.

™Prestel and the Prestel symbol are trademarks of British Telecommunications.

Making the most of your micro.

WOODLAND SOFTWARE

For the best from Strategic Simulations Inc.!

		AP	AT	64	RRP	Our Price
War In Russia	New!	/			£60.00	**£54.00**
Objective Kursk	New!	/			£43.15	**£38.80**
Questron	New!	/	/		£35.95	**£32.30**
50 Mission Crush	New!	/	/	/	£28.75	**£25.80**
Rails West	New!	/	/		£28.75	**£25.80**
Fighter Command		/			£43.15	**£38.80**
Carrier Force		/	/		£43.15	**£38.80**
Bomb Alley		/			£43.15	**£38.80**
Eagles		/	/	/	£28.75	**£25.80**
Germany '85		/		/	£43.15	**£38.80**
RDF '85		/		/	£25.75	**£23.55**
Fortress		/	/	/	£25.15	**£22.65**
Southern Command		/			£43.15	**£38.80**
North Atlantic '86		/			£43.15	**£38.80**
Battle for Normandy		/	/	/	£28.75	**£25.80**
Ambush (2nd Ed)		/			£43.15	**£38.80**
Knights of the Desert		/	/	/	£28.75	**£25.80**
Broadsides		/	/		£28.75	**£25.80**
Quarterback		/			£28.75	**£25.80**
Galactic Adventures		/			£43.15	**£38.80**
Galactic Gladiators		/			£28.75	**£25.80**
Cosmic Balance		/	/	/	£28.75	**£25.80**
Cosmic Balance II		/	/		£28.75	**£25.80**
Ringside Seat		/		/	£28.75	**£25.80**
The Road To Gettisburg		/			£43.15	**£38.80**
Geopolitique 1990		/			£28.75	**£25.80**

AP = APPLE AT = ATARI 64 = COMMODORE 64

Please add 15% VAT — Post & Packing free.
A full list of what we have available is free on request.
Personal callers by appointment only — 24 hour service 7 days a week!

WOODLAND SOFTWARE
103 Oxford Gardens, London W10 6NF
Telephone: 01-960 4877

KNIGHTS UNBEATABLE SHARP DEALS

DEAL 721+4 £215 76K MZ-700 with built-in cassette recorder supplied with over £150 worth of software including FOUR computer languages — BASIC, PASCAL, FORTH and MACHINE CODE.
PLUS 50 programs to get you off to a flying start: Teach Division, Teach Music, Statistical Analysis, Regression Curve Fitting, Cribbage, Poker, Cosmic, Puckman, Vicious Viper, Circus Star, Mastermind, Suicide Run, Exploding Atoms, Budget Forecasting Accounts etc, and our special BASIC Tutorial which helps you learn programming.

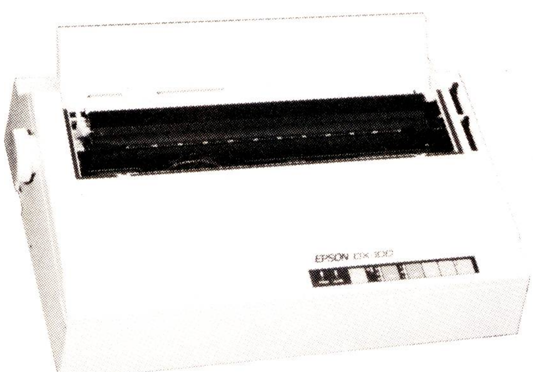
DEAL 731+4 £326 MZ-700, cassette, languages & programs as above with the 4 colour printer/plotter built in. Best value in computers. Why buy a slow micro that is stuck in BASIC with no printer or cassette?

P.S. WE HAVE SOLD THOUSANDS OF SHARP PRODUCTS ALL OVER THE WORLD DURING THE LAST 9 YEARS AND HAVE NEVER HAD TO CHARGE FOR A SINGLE REPAIR. WE GUARANTEE TO BEAT ANY COMPETITORS' PRICE ON THE SPOT.
Export customers — all prices are free on board Aberdeen — no VAT. UK customers get free Securicor delivery but remember to add VAT.

Knights T.V. &
COMPUTERS

108 ROSEMOUNT PLACE,
ABERDEEN AB2 4YW
Telephone: 0224 630526
Telex: 739169 "KNIGHTS TV"

Personal or Professional — THE DX 100 from EPSON



The DX is a 13CPS full facility Daisywheel, compatible with Diablo® operation making it eminently suitable for Wordstar® and most other word processing packages.
Options for the DX include a cut sheet feeder, tractor unit, keyboard and RS232 interface.

CASH AND CARRY NOW WHILE STOCKS LAST ONLY **£450.00** PLUS VAT

OTHER EPSON PRINTERS IN STOCK

ARNOLD BROS.

Tudor Chambers, 1773 London Road, Leigh-on-Sea, Essex.
Tel. 558530/558337

DOT MATRIX PRINTERS

Epson RX80/RX80FT £220/250
Epson FX80 £330
Epson MX100/FX100 £370/425
Epson interfaces from £27
Logitec FT5000 £239
Shinwa CP80 £175
Riteman £199
Riteman RS232/Tractor £34/24
Toshiba 2100H/2100G £1280/1495
Seikosha GP250X/GP700A £185/325
Seikosha GP500A/550A £155/220
Star Gemini 10X/15X £204/287
Star Delta 10/15 £317/420
Star Radix 10/15 £441/533
Star RS232 I/F £43
Microline 80/82A £165/245
Microline 92(P)/83A £365/395
Canon PW1080A/PW1156A £272/339
Canon PJ1080A COLOUR £360
Mannesmann MT80/MT160 £195/390
Microprism £322
Prism 80S/80SGFC £848/1175
Prism 132S/132SGFC £925/1342

DAISYWHEEL PRINTERS

Brother HR1 £500
Brother HR15/HR25 CALL
Brother keyboard & accessories CALL
Daisy Step 2000 £240
Silver Reed EXP 500 £276
Smith Corona TP1 £200
Juki 6100 £340
Juki RS232/Tractor/Sh feed £50/92/207
NEC 2010/2030 £640
Ricoh RP1300S/1600S £890/1180
Ricoh Flowriter 1300QD £980
Dyneer DW16(P)/DW36(P) £272/720
Qume 11-40/11-55 £1175/1360
Hermes 612C £1500
Diablo 620(RO)/630(ECS) £670/1680

MONITORS

Zenith 123E 12" Amber £85
Zenith 13" 135E Colour Hres £372
Sanyo DM2112 12" Green £67
Sanyo 14" Colour Nres £161
Microvitec CALL

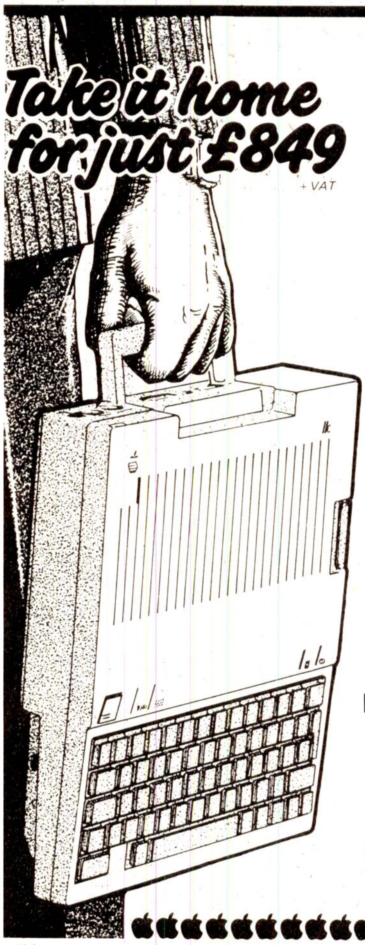
REMEMBER: This is only part of our extensive and growing range. If you cannot see what you want give us a call on 0432 271114!!

Introducing
THE WRITTEN WORD (Software Information Systems) **LTD**
EDUCATIONAL SOFTWARE & INFORMATION SERVICES FOR THE BBC MICRO.
SOFTWARE FOR THE SERIOUS BUSINESS & HOME USER. **WATCH THIS SPACE**

Please add VAT at the current rate to all prices. Advertised prices are subject to change without notice E&OE, and are based on cash with order terms. Next day carriage £8 (+VAT) per box, postage £1.50 on small orders. Telephone to confirm latest prices. large SAE (22p postage) for price list. Callers by appointment only please. Hours 9-5.30.

GOLDEN VALLEY COMPUTERS LTD
11 Tarsmill Court, Rotherwas Industrial Estate, Hereford HR2 6JZ.
Tel: (0432) 271114

The NEW Apple IIc



Take it home for just £849 + VAT

Full-size keyboard but fits in a briefcase
128k memory   Apple / / family compatable
(Runs most Apple programs)

Built-in:—
143k Apple 5¼" disk drive and controller
40/80 column display in upper & lower case
Modulator for 16 colour graphic display for home TV or professional monitor
Speaker & headphone jack with volume control
Ports for Serial Printer and Modem
Second Disk Drive socket

Weighing in at 7½lbs, the best all-in portable yet. For just £849 (+VAT) . . .

you've got it in one.

And you can plug-in lots of extras including:–
2nd Disk Drive, Hard Disk, Network
Mouse, Joystick & Hand-controllers
Printer, Colour Plotter, Modem
Professional Monitor
Flat-screen *(available Autumn 84)*
Carrying Case, etc, etc

Supplied only after pre-payment. Allow 7-14 days for delivery and cheque clearance. Subject to availability. Delivery & Insurance if required (UK only) £11 (+VAT) (Total delivered price including VAT £989)

Come along for a demonstration

Vega Computers Limited
10 Essex House George Street
Croydon CR0 1PH
Tel: 01-656 8431, 01-680 4484
Telex 943763

EPSON QX10

PHONE 01-337 4541

CONCORDIA *THE EXPERTS*

COMPLETE BUSINESS COMPUTER INSTALLED FOR UNDER £2,000

Yes a complete system, Printer, Computer and programs for Accounting Spreadsheet and Wordprocessing. We supply spare disks, paper, dust covers, we even train your staff. Epson high quality equipment, Peachtree high quality programs (Peachtext, Mail list, Peachcalc) and Concordia expert help, an unbeatable combination to get you started. The simple to use QX 10. Ideal for the first time user, it also has the power and facilities to satisfy the most demanding expert. The price includes CP/M, MFBASIC twin double sided double density disk units, high resolution VDU, 192K RAM, a music generator and interfaces for RS232, Centronic parallel, and a light pen. Of course the QX 10 has 16 Bit precision, High resolution graphics, keyboard graphics, and many function keys. It also gives you 16 type faces to choose from and they all print out on the Epson printer. This package is really complete, no extras to buy, we even supply the 13 amp plugs. All you have to do is write the cheque (The price £1999 plus vat).
This could be the best investment you have ever made.

RING 01-337 4541 NOW.

Concordia (Est 1971), give *after sales support*

6 CENTRAL ROAD, WORCESTER PARK, SURREY KT4 8HZ

M-TEC

AT LAST! **BBCBASIC** to run on YOUR CP/M Computer

BBCBASIC(Z80)

Now available for the TORCH and DISKPACK with full GRAPHICS

WHY STRUGGLE ON using OLD FASHIONED BASICs when you can have ALL THE ADVANTAGES OF **BBCBASIC(Z80)** on your computer?

Of course, we can't turn your computer's video display into a high resolution colour monitor, but we can give you all the other features of **BBCBASIC** including:-

- **LONG VARIABLE NAMES**
- **MULTI-LINE REPEAT UNTIL STATEMENTS**
- **MULTI-LINE NAMED FUNCTIONS**
- **MULTI-LINE NAMED PROCEDURES**
- **POWERFUL DIRECT MEMORY MANIPULATION USING THE INDIRECTION OPERATORS**
- **AN IN-LINE ASSEMBLER USING STANDARD Z80 MNEMONICS**
- **VERY SOPHISTICATED PARAMETER PASSING IN THE CALL STATEMENT**
- **SERIAL RANDOM AND INDEXED DISK FILES PLUS THE ABILITY TO ACCESS ANY BYTE IN THE FILE**
- **CLEAR SCREEN, TAB(X), TAB(X,Y), POS, VPOS and TIME**

Plus ALL THE OTHER STANDARD COMMANDS etc.

You can copy any program written in older 'standard' versions of BASIC with little change OR you can write well-structured and easy to read programs like a professional.
You need never say GOTO again. But we won't stop you.

Price, including postage, £95 + VAT

TORCH version including SOUND and GRAPHICS £110 + VAT

BBCBASIC(Z80) will run on any computer using CP/M 2.2 or later and a Z80 processor. It comes complete with an instruction manual, a tutor on file handling and configuration notes.

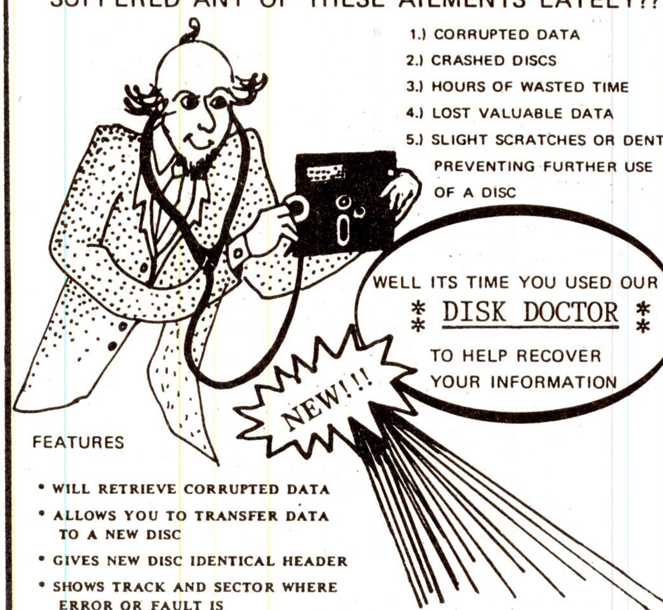
Trade enquiries welcome

M-TEC Computer Services (UK), Ollands Road, Reepham, Norfolk

Telephone Norwich 870620   **Prestel Mailbox Nos. 603870620**

SUFFERED ANY OF THESE AILMENTS LATELY???

1.) CORRUPTED DATA
2.) CRASHED DISCS
3.) HOURS OF WASTED TIME
4.) LOST VALUABLE DATA
5.) SLIGHT SCRATCHES OR DENTS PREVENTING FURTHER USE OF A DISC



FEATURES

- WILL RETRIEVE CORRUPTED DATA
- ALLOWS YOU TO TRANSFER DATA TO A NEW DISC
- GIVES NEW DISC IDENTICAL HEADER
- SHOWS TRACK AND SECTOR WHERE ERROR OR FAULT IS
- WILL ALLOW YOU TO RE-USE ORIGINAL DISC IF NOT PHYSICALLY DAMAGED
- USER FRIENDLY AND EASY TO OPERATE
- A FREE DISC TO TRANSFER YOUR DATA TO.
- SECURITY BACKUP OF MOST DISCS

****
FREE BLANK DISK
INCLUDED*

commodore 64

PRICE £ 15.95 inc. VAT

Postage and packing

CHEQUES AND P.O.'s to: MERMAID SOFTWARE

*27 Buckingham Gardens,
Edgware,
Middlesex.   HA8 6NB.*

Teach yourself software in minutes. Not hours.

Insert an ATI training disk, and presto! Three minutes later, you're practicing usable skills. Within an hour, you're proficient.

Even if you're never touched a computer before.

ATI's self-prompting disk simulates the actual software on the screen of your personal computer. If you have a question later, the helpful handbook is set up to give you the answer in 15 seconds.

ATI Training Power is faster because it's Performance Based. Instead of taking time teaching you how a program works, ATI shows you how to put it to work. Right away.

ATI's unique Performance-Based Training is widely used by many Fortune 500 companies, such as IBM, DEC, Xerox, NEC, and Toshiba. Not to mention thousands of small businesses.

ATI's training programs operate in virtually every business oriented microcomputer.

Match ATI's selections with your software library, and order today.

Integrated Software

ATI Training Power makes it easy to learn and use the powerful new integrated software packages currently entering the market.

Word Processing

ATI's Word Processing Series teaches you how to create, edit, move, and print text with popular programs, fast! A must for executives and secretaries alike.

Database Management

To get the most out of your data base, learn to use these programs fast, with ATI's Database Management Series.

Financial Planning

What if you could learn to do a complete "what if" spreadsheet analysis in less than an hour? ATI's Financial Planning Series teaches you this and more. Turn software packages into powerful management tools, quickly.

Operating Systems

Learn to prepare, monitor, maintain, and troubleshoot your own system like a pro, with ATI's Operating Systems Series.

Programming

ATI's Basic Programming Series teaches you how to write, enter, debug, and use programs that analyse business expenses, organize mailing lists, and more.

Accounting

Now it's easy to put your accounting on computer, with an outstanding software package and ATI Training Power to get you (and your bookkeeper) up to speed, rapidly and cost-effectively.

Please rush me ATI Training Power™ programs, at $75 each for this software:

Integrated Software
☐ Lotus 1-2-3

Database Management
☐ dBASE II-vol. 1 & 2
☐ EasyFiler

Word Processing
☐ WordStar-vol. 1 & 2
☐ EasyWriter II
☐ Perfect Writer
☐ Spellbinder
☐ Benchmark

Financial Planning
☐ Multiplan
☐ SuperCalc
☐ VisiCalc
☐ Perfect Calc
☐ EasyPlanner
☐ Microplan

Operating Systems
☐ PC DOS
☐ MS DOS
☐ CP/M

Programming
☐ BASIC
☐ APPLESOFT BASIC

Accounting
☐ BPI Gen. Acct.
☐ Peachtree General Ledger*
☐ Peachtree Accounts Receivable*
☐ Peachtree Accounts Payable*
*PC(MS) DOS formats only.

My Disk Drive is:
☐ SSSD
☐ DSDD
☐ SSDD
☐ DSSD

My computer brand is: ____________________

Enclosed is $75 each plus $15.00 shipping

Name ____________________ Phone (   ) ____________________

Street ____________________

City ____________________ State ____________________ Zip ____________________

Mail order form to:
American Training International
3770 Highland Avenue, Suite 201,
Manhattan Beach, CA 90266
Telex: 364412 INTR

ATI Money Back Guarantee
If you're not completely satisfied with how fast you learn with ATI Interactive Training Programs, simply return it within 3 days for full purchase refund.

ATI Training Power™

Is the writing on the wall for other printers?

Looking for the perfect printer for your micro? Look no further than Dataproducts – the world's biggest independent printer maker, and 'own label' supplier to most of the major computer manufacturers.

Now that same quality is available direct to you at competitive prices from your nearest dealer. Whether you want it for letters, reports, bar-charts or spread sheets. Feature for feature, we knock spots off the competition.

Like the new 80-column 8010 shown here, or the 8020 132-column version, both near letter-quality dot matrix printers with three printing speeds for data or word processing. That handle multi-part forms and single sheets as easily as continuous stationery. That mix text and graphics in a single line; that are ideal for office or home use.

(They've got combined serial and parallel interfaces on the one card, too, as well as IBM PC-compatible 8011 and 8021 versions.)

Or the P132 colour printer, that again outperforms the competition. Whatever your micro, whatever your printer requirements, you'll find our Paper Tigers exactly right for the job.

Take a look at them at your local dealer and find out how you could be one of the lucky winners of a two-week African Photo Safari, plus valuable runner up prizes.

Paper Tigers from Dataproducts. Bite for bite, the best!

Dataproducts Limited, Retail Division,
136/138 High Street, Egham, Surrey TW20 9HL.
Tel: (0784) 38733. Telex 298562.

Dataproducts

Nobody puts ideas on paper so many ways.

PaperTiger

Low Prices

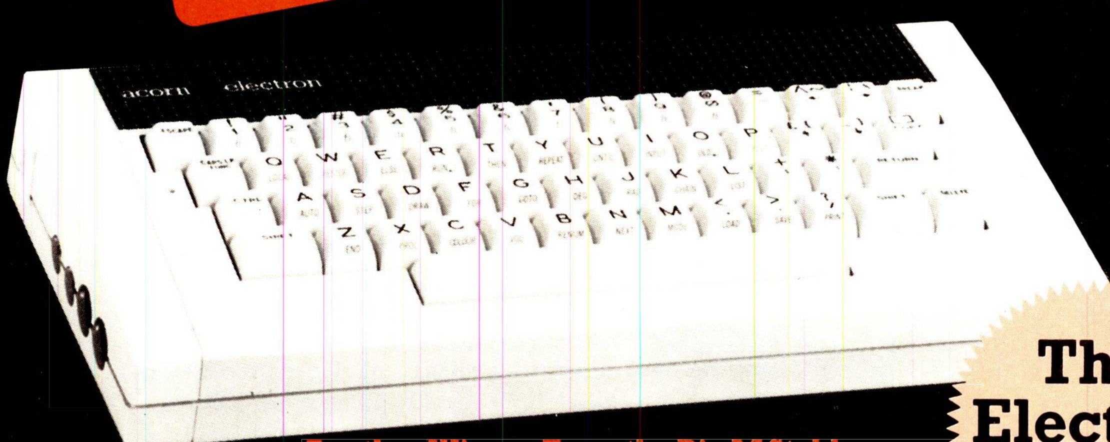
Best Service

Up to £1000 instant credit
— write for details

★ Europe's No. 1 Group of Retail Outlets

★ Check our multi-national network for your nearest dealer

★ Backed by an after-sales service second to none



The Electron £199.00

Another Winner From the Big M Stable

The Electron — A thoroughbred from the manufacturers of the BBC, who have incorporated all their experience and knowledge to conceive another winning computer. Many BBC programs are compatible. This full colour 32K ROM and RAM computer with text and graphics includes a cassette input, and a multi-way connector for the addition of expansion units containing interfaces to additional hardware. It has a 56 key full travel QWERTY keyboard, 10 user-definable and 29 pre-defined keys enabling BASIC keywords to be entered in a single keystroke. The Electron comes with free introductory cassette containing 19 programs including a number of exciting games. £199.00

Low Prices

£839.50 TORCH Z80 Disk Pack 800K

TORCH Z80 – Disk Pack 800K – £839.50
Dual disk drive with Z80 second processor and CPM for BBC. Gives BBC 64K of usable RAM.

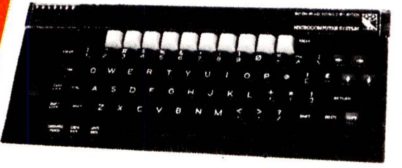
Sinclair ZX Spectrum – 16K – £99.95, 48K – £129.9
16K and 48K basic, colour and text graphics.

Sinclair ZX Spectrum from £99.95

Commodore 64 – £229.00
Colour sophisticated ROM/RAM user, UHF/ Composite video, high resolution graphics.

£229.00 Commodore 64

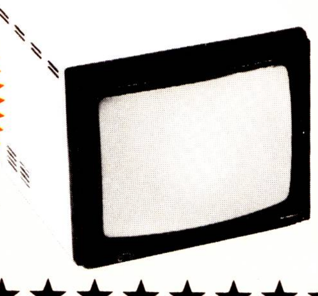
BBC Model B £399.00



BBC Model B – £399.00
Full colour 32K ROM Computer with text and graphics 80 column text screen, extended Microsoft basic, built in assembler 1MHz and tube interface, sideways ROM RS 423, A/D converter.

MONITORS
RGB Colour Monitor STD/RES £228.85
RGB Colour Monitor H/RES £632.50
12″ Green Monitor £99.00 12″ Amber Monitor £120.75
Fidelity MTV1400 Monitor/TV £247.25

MONITORS from £228.85



Double Density DFS – £120.00
Disk controller for the BBC Micro. Up to 2MB on line storage. Auto internal format programs for 5¼″ and 3″ drives. Acorn compatible runs basic, wordwise, BCPL, view forth etc. 25% faster than Acorn DFS on file access. Auto 40-80 track switching. Compatible with .1 DFS view and sideways ROM.

Double Density DFS £120.00

The Big Interna

Altrinchar
Pharmacy Computer Systems
37 Stamford New Road
Altrincham
Cheshire
Tel: 061 928 0087

Ashford
Tollgate Video
249 Beaver Road
Ashford
Kent
Tel: 0233 37187

Beverley
Beverley Computer Centre
1 Windmill Passage
55 Lairgate
Beverley
N. Humberside
Tel: 0482 881911

Bishop's Stortford
County Computer Stores
95a South Street
Bishop's Stortford
Herts
Tel: 0279 506801

Bolton
Selecta Video
5 Belmont Road
Astley Bridge
Bolton
Lancs
Tel: 0204 52804

Braintree
Braintree Computer Centre
Masefield Road
Braintree
Tel: 0376 24922

Bridgend
Automation Services
42 Dunraven Place
Bridgend
Mid. Glam
Tel: 0656 3550

Brighton
Gamer
24 Gloucester Road
Brighton
Sussex
Tel: 0273 698424

Brixham
Computer Systems (Torbay)
Pump Street
Brixham
Devon
Tel: 08045 6565

Bromley
Data Store
6 Chatterton Road
Bromley
Kent
Tel: 01-460 8991

Bury
Entertainment in Leisure
88 The Rock
Bury
Tel: 061 797 3463

Cambridge
G.C.C. Cambridge Ltd
66 High Street
Sawston
Cambridge
Tel: 0223 835330

Canterbury
Canterbury Software Centre
9 The Friars
Canterbury
Kent
Tel: 0227 53531

Cardiff
Steves Computer Centre
Castle Arcade
Cardiff
Tel: 0222 41905

Chelmsford
Essex Computer Centre
216 Moulsham Street
Chelmsford
Essex
Tel: 0245 358702

County Antrim
Everyman Computers
80 Charlotte Street
Ballymoney
Co. Antrim
N. Ireland
Tel: 02656 62116/62658

Croydon
Concise Computer Consultants Ltd
1 Carlton Road
South Croydon
Surrey
Tel: 01-681 6842

Dartford
Anirog Computers
29 West Hill
Dartford
Kent
Tel: 0322 92513

Derby
First Byte Computers
10 Castlefields
London Road
Derby
Tel: 0332 365280

Dover
Dover International Computer Centre
18/19 The Charlton Arcade
High Street
Dover
Kent
Tel: 0304 212433

Dyfed
Computer Centre
18 Riverside Market
Haverford West
Dyfed
Tel: 0437 2776/68228

Harlow
County Computer Stores
5a West Square
Harlow
Tel: 0279 414692

Hastings
The Computer Centre
37 Die Robertson Street
Hastings
East Sussex
Tel: 0424 439190

Harpenden
Hobbyte
153 Grove Road
Harpenden
Herts
Tel: 0587 3542

Heckmondwike
Thoughts and Crosses
37 Market Street
Heckmondwike
W. Yorkshire
Tel: 0924 402 337

Hemel Hempstead
Faxminster Ltd
25 Market Square
Hemel Hempstead
Herts
Tel: 0442 55044

High Wycombe
South Bucks Computer Centre
Hull Loosley & Pearce
120/123 Oxford Road
High Wycombe
Bucks
Tel: 0494 442311

Hornchurch
Comptel Computer Systems
112a North Street
Hornchurch
Essex
Tel: 04024 46741

Horsham
The Micro Store
13b West Street
Horsham
W. Sussex
Tel: 0403 52297

Horsham
Orchard Business Systems Ltd
34 East Street
Horsham
W. Sussex
Tel: 0403 68461

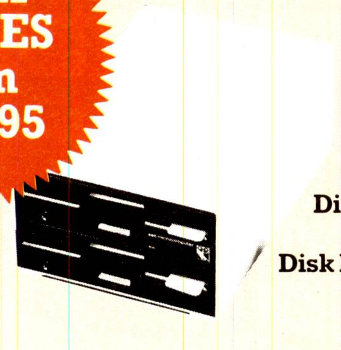
Ipswich
Brainwave
24 Crown Street
Ipswich
Suffolk
Tel: 50965

London
Computers of Wigmore Street
87 Wigmore Street
London
Tel: 01-486 0373

★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★★

3est Service

DISK DRIVES from £159.95

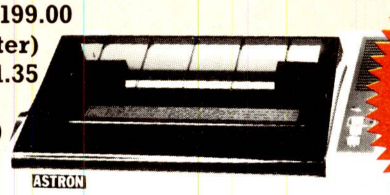


DISK DRIVES
Disk Drive 100K Single £159.95
Disk Drive 200K Single £241.50
Disk Drive 400K Single £396.75
Disk Drive 800K Dual £711.85

£895.00 Commodore SX64 Portable

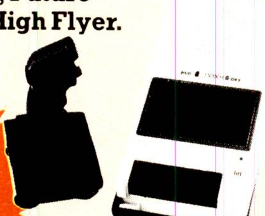
Commodore SX64 Portable – £895.00
9″ full colour screen, Commodore 64 compatible. Built in Disk Drive, Easy Script, Future Finance Easy File and High Flyer.

PRINTERS
Astron JP80 (as ill.) £199.00
MCP40 (Colour Printer) £171.35
Epson RX-80 Printer £314.00
Epson FX-80 Printer 160cps £399.00



PRINTERS from £199.00

Joystick & Cassette Players



Joystick & Cassette Players – Many joysticks and cassette players available from stock. Just in . . . The BBC Compatible Crack-Shot. £10.95

SOFTWARE

SOFTWARE all leading chart software available

LYNX 96K – £299.00
Full high resolution colour, it offers 37.5K of RAM in basic, and 24K more to programs using machine code.

LYNX 96K £299.00

Many more hardware, software and peripheral products coming your way from the "Big M"

›nal Dealer Network ★★★★★★★★★★★★★★★★★★★★★★★★★

ondon
latmos
l/16 Childs Place
arls Court
ondon
el: 01-373 5000/6607

ondon
lenry's Radio
omputer Department
04 Edgware Road
ondon
el: 01-402 6822

Maidenhead
hiswick Organs
5 Nicholsons Walk
laidenhead
el: 0628 31765

Marlow
itybench
/4 Eaton Place
larlow
ucks
el: 06284 75244

Merseyside
Source Computers Ltd
4 Cross Lane
Newton-Le-Willows
Merseyside
Tel: 09252 29049

Milton Keynes
Micro Land
Weatherburn Court
Brunel Centre
Bletchley
Milton Keynes
Tel: 0908 368018

Norwich
Abacus
12a Pottersgate
Norwich
Norfolk
Tel: 0603 614441

Peterlee
General Northern Computing
8 Whitworth Road
South West Ind. Estate
Peterlee
Durham
Tel: 0783 860314

Preston
Format Computing
67 Friar Gate
Preston
Lancs
Tel: 0772 561952

Taunton
Sinewave Computer Services
Corporation Street
Taunton
Somerset
Tel: 0823 57526

Tewkesbury
Sabre Consultants Ltd
103 High Street
Tewkesbury
Glos
Tel: 0684 298866

Scunthorpe
Ashby Computer Centre
186 Ashby High Street
Scunthorpe
S. Humberside
Tel: 0724 871756

Skipton
Skipton Computer Systems
16 Swadford Street
Skipton
N. Yorkshire
Tel: 0756 68192

Southend
The Home Computer Centre
261 Victoria Avenue
Southend-on-Sea
Essex
Tel: 0702 43568

Southall
Twillstar Computers
17 Regina Road
Southall
Middx
Tel: 01-574 5271

St. Austell
Computavision
4 Market Street
St. Austell
Tel: 0726 5297

Stirling
Micro Store
38 The Arcade
King Street
Stirling
Central Region
Tel: 0786 64571

Stoke-on-Trent
Town Computer Store
30 Town Road
Hanley
Stoke-on-Trent
Tel: 0782 287540

Stroud
The Model Shop
22 High Street
Stroud
Glos
Tel: 04536 5920

Uxbridge
J.K.L. Computers
7 Windsor Street
Uxbridge
Middx.
Tel: 0895 51815

Welling
North Kent Computer Centre
52/54 Bellgrove Road
Welling
Bedley
Kent
Tel: 01-301 2677

Whitley Bay
Video & Home Computers Centre
3 Roxburgh House
Park Avenue
Whitley Bay
Tyne & Wear
Tel: 0632 534725

Wolverhampton
Wolverhampton Computer Centre
17/19 Lichfield Street
Wolverhampton
Tel: 0902 29907

Worthing
Worthing Computer Centre
32 Liverpool Road
Worthing
W. Sussex

For your nearest European Dealer telephone Belgium or Holland

Belgium
Micro Management
Belgium
Ballaerstraat 75
2018 Antwerp
Belgium
03-238 9284

Holland
Micro Management
Nederlands
Raad Huisstraat 98 2406
Ah Alphen-aan-den-rijn
01720-72580

A 16-bit Personal Business Computer for Professionals.

Duet-16

THE TRUE AND HIGHTEC 16 BIT...

... FROM JAPAN'S MOST ADVANCED AND WELL-KNOWN MICRO/MINI COMPUTER MANUFACTURER, **PANAFACOM**, TIED UP WITH **SAKATA**.

Processor	Intel 8086 running at 8 MHz
RAM memory	128 K expandable to 512 K
Operating System	MS-DOS Ver 1.25/2.00 CP/M-86
Display Unit	Super high resolution colour or monochrome, 640 x 400 pixels.
Keyboards	ASCII, UK, French and German. Other local keyboards available on request.
Communication	2-serial port and one Centronics parallel port as standard. IEEE-488 is optional.

System expansion Unit

Disks	2 x 720 Kbyte floppy disk 10 and 20 M byte Winchester disks are optional.

Expansion Unit 5 expansion slots and 10 M byte Winchester disk with Cache memory.

Complete System with Color-Graphic

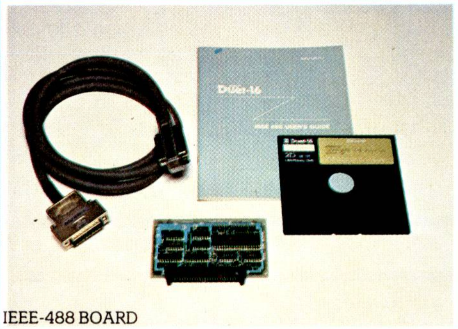
Integrated Desk Top Micro as well as portable for your business, supported by different application packages.

Fastest speed with excellent colour capability and full range of softwares.

Well designed to meet current and future demand.

Quality micro with reasonable price you have never seen.

Software
BASIC-86, Advanced BASIC, L-II COBOL, FORMS-2, ANIMATOR, Multiplan, WordStar, SpellStar, MailMerge, TSS support program, 1-3270 emulator



IEEE-488 BOARD

MS-DOS, BASIC-86 and Multiplan are trademarks of Microsoft Corporation. Wordstar, MailMerge and SpellStar are trademarks of MicroPro International Corporation. LEVEL II COBOL, FORMS-2 and ANIMATOR are trademarks of Micro Focus Limited. CP/M-86 is a trademark of Digital Research Inc. Duet-16 is a trademark of SAKATA SHOKAI, LTD.

COUPON Please send us more information about:

☐ DUET-16 ☐ Printers ☐ Monitors
☐ Plotters ☐ Floppy-Disk Drive

Name: City:

Street: Phone: PCW 7·84

SKT SAKATA SHOKAI GmbH
Kleinhulsen 15, D-4010 Hilden, West Germany
Tel. 010 49 2103 5730 · Tlx 8581689 Sktd · Telefax 02 11-32 59 19

SAKATA UK Rep Office: 48 Sutton Park, Broad Blunsdon, Swindon, Wiltshire SN2 4VV. Tel: 0793 721419. Tlx: 449666.

Other products: low-cost peripherals – printers, plotters, monitors and floppy-disk drives. Now available. Please enquire.

FOR THE BBC MICRO

SOFTWARE

TINY PASCAL
Pascal-T is a 16k Eprom program capable of compiling Source Pascal into a compact and very fast threaded-interpretive-code. Full editor and disc-support are included and the program is supplied together with comprehensive documentation. **PRICE £59.00 + V.A.T.**

X CAL
An eXpert Computer Aided Learning package in 16k Eprom and support disc. No programming skill required to construct learning 'sessions' as the program is 'screen' driven. Facilities include Text pages, Graphics and Histograms. **PRICE £65.00 + V.A.T.**

FORTH
FIG-FORTH in 8k Eprom together with manual. **PRICE £34.72 + V.A.T.**

LOGO-FORTH
A 16k Eprom program introducing this very powerful but extremely friendly Turtle-Graphics language. Users also have full access to the Fig-Forth support nucleus. Full documentation is included. **PRICE £59.00 + V.A.T.**

M–UTS
Powerful machine code monitor with disc utilities. **PRICE £19.95 + V.A.T.**

(Special discounts available for educational establishments for all the above software)

HARDWARE

Always in stock Printers, Disc Drives IC's etc.

FOR THE EPSON HX20

SOFTWARE
FORTH ROM including full documentation. **£34.72**

HARDWARE
Expansion Unit, Paper, Microcassettes etc. Please phone for quotes

Retail/Mail Orders/Dealers enquiries to:
HCCS Associates
533 Durham Road, Low Fell,
Gateshead, Tyne & Wear
NE9 5EY
Tel: (0632) 821924

Retail sales also at:
HCCS Microcomputers
122 Darwen Street
Blackburn, Lancs.
Tel: (0254) 672214

DISC DRIVES
Sinclair QL compatible

These you really need. Such a beautiful computer and no fast large scale storage! Our disc drives are Teac or Epson and are complete with case, controller, power supply connecting cables and mains plug. Twelve months full warranty. Use still allows RAM etc to be added later. Plug in and go.

- ★ Single cased, dual sided 40 track 500K total unformatted **£351.00**
- ★ Dual cased, dual sided 40 track 1 Mbyte total unformatted **£538.00**
- ★ Single cased, double sided 80 track 1 Mbyte total unformatted **£372.00**
- ★ Dual cased, double sided 80 track 2 Mbyte total unformatted **£585.00**
- ★ Single cased Drivetec 320, 3.3 Mbyte total unformatted **£644.00**
- ★ Dual cased Drivetec 320, 6.6 Mbyte total unformatted **£1,099.00**

All prices + VAT, delivery included.

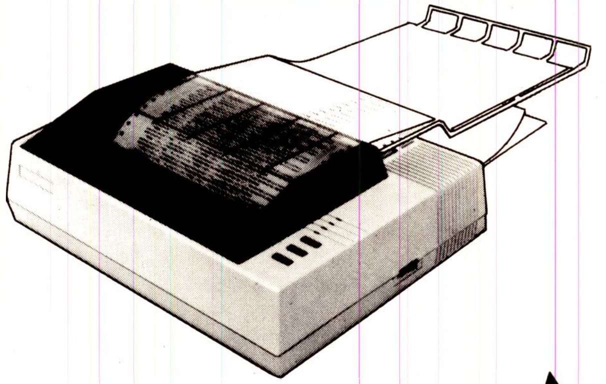
X COM (Services) Limited
648 High Road, London E10 6RN
Telephone: 01-539 4147. Telex: 8954853

SINCLAIR and QL are trade marks of SINCLAIR RESEARCH LIMITED

MICRO~LITE 80

LOW COST-HIGH QUALITY DOT MATRIX PRINTER

LOOK AT THE PERFORMANCE



- ★ 80 CPS ★ DOUBLE STRIKE PRINT
- ★ BIDIRECTIONAL (LOGIC SEEKING)
- ★ SUB SCRIPT AND SUPER SCRIPT
- ★ CONDENSED PRINT ★ ITALIC PRINT
- ★ GRAPHICS ★ EMPHASISED PRINT
- ★ EXPANDED PRINT ★ SELF TEST
- ★ AUTO—UNDERLINE ★ HORIZONTAL AND VERTICAL TABS
- ★ TRACTOR AND FRICTION FEED

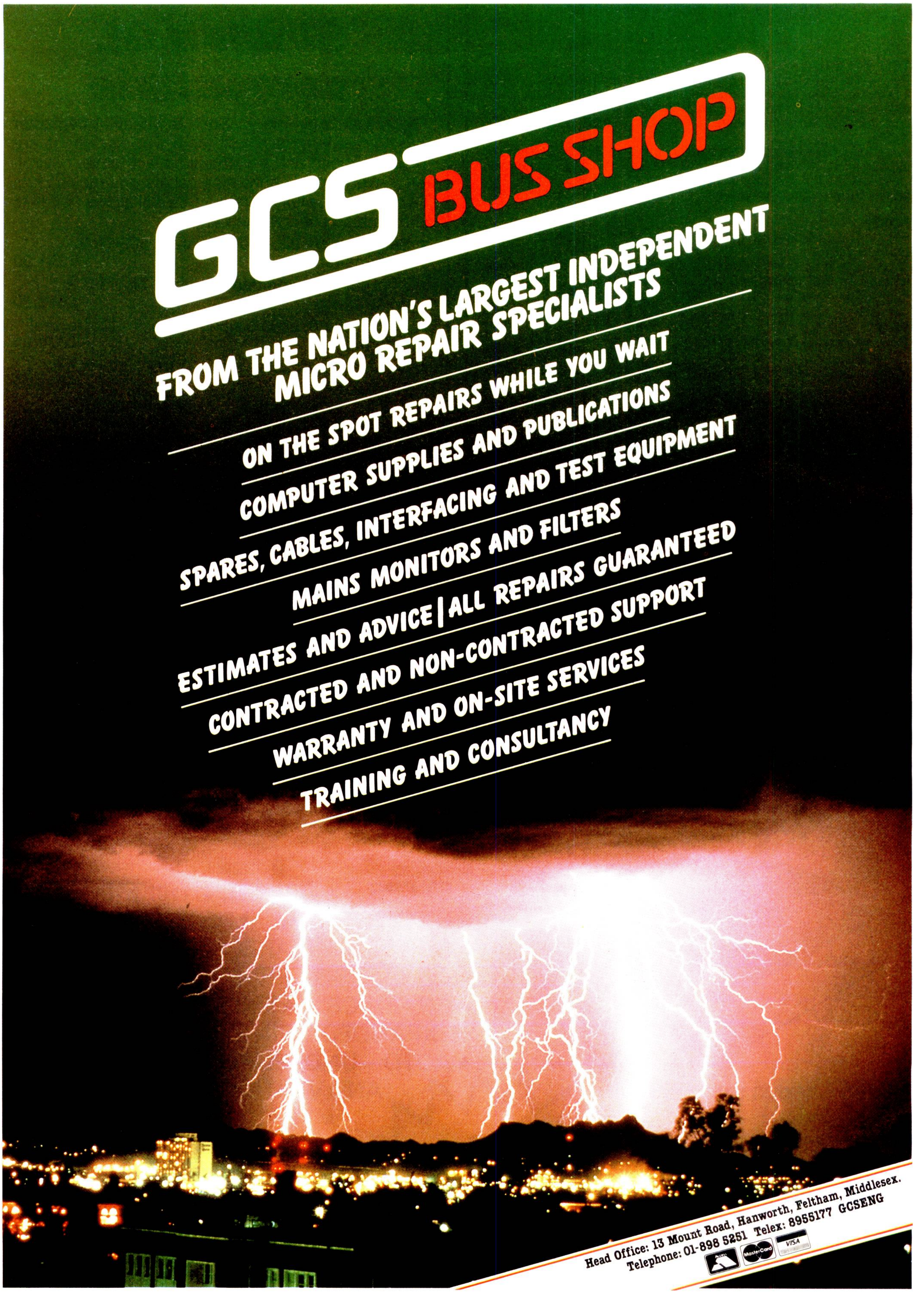
Send Cheque for £210.00
(Inc VAT P&P)
FOR IMMEDIATE DELIVERY

£180
Plus VAT P&P

POWERFUL PERFORMANCE AT LOW COST

SELECT COMPUTER PRODUCTS
P.O. BOX 183
70 CHARLOTTE ROAD
EC2A 3DJ
TEL : 01-739 5692

LOOK AT THE PRICE !


GCS BUS SHOP
FROM THE NATION'S LARGEST INDEPENDENT MICRO REPAIR SPECIALISTS
ON THE SPOT REPAIRS WHILE YOU WAIT
COMPUTER SUPPLIES AND PUBLICATIONS
SPARES, CABLES, INTERFACING AND TEST EQUIPMENT
MAINS MONITORS AND FILTERS
ESTIMATES AND ADVICE | ALL REPAIRS GUARANTEED
CONTRACTED AND NON-CONTRACTED SUPPORT
WARRANTY AND ON-SITE SERVICES
TRAINING AND CONSULTANCY
Head Office: 13 Mount Road, Hanworth, Feltham, Middlesex.
Telephone: 01-898 5251 Telex: 8955177 GCSENG
VISA

BUY YOUR DRAGON A FRIEND

Here's a friend your Dragon has always wanted — a Cumana disk drive; and Cumana slimline disk drives are friendly to you, the user, as well as to your pocket.

Designed and manufactured to the highest standards, Cumana disk drives have an independent power supply, 12 months warranty, and are fully assembled and tested before packaging. As part of the package, your first disk drive for the Dragon — addressed by Cumana as drive A — is supplied with a comprehensive user manual, 'DELTA' ROM based cartridge adaptor and demonstration diskette. Upgrading your system is simple, and up to four Cumana disk drives can be added without any modification to your microcomputer.

Cumana slimline disk drives for the Dragon Microcomputer are now available from Spectrum UK, as well as area distributors and Cumana's national dealer network. Look out for the distinctive Cumana packaging in your high street, today!

Dragon is the registered trademark of Dragon Data Ltd.
Delta is supplied by Premier Microsystems Ltd.

For further information about Cumana disk drives for the Dragon Micro, please complete and return this coupon.

Name ____________________

____

Address ____________________

____

____

Tel. No. ____________________

Interests:

- Home Use ☐
- Education ☐
- Dealer ☐
- Business ☐

PCW 7/84

Note: If dealer, please attach this form to your letterheading.

CUMANA

The best name in memory

Cumana Limited, Pines Trading Estate,
Broad Street, Guildford, Surrey, GU3 3BH.
Telephone: Guildford (0483) 503121 Telex: 859380

'MAINT-INSURE'

NOW A more EXTENSIVE yet LOWER PRICED alternative to computer MAINTENANCE

YET Providing FULL engineering support services nationwide

'MAINT-INSURE's' **insurance** covers:

- Fire and theft
- Accidents, negligence, operator error
- Electrical or mechanical breakdown
- Damage in transit
- Cost of recompiling data

IN SUMMARY

MORE EXTENSIVE COVER THAN NORMAL MAINTENANCE AND NO ADDITIONAL COMPUTER INSURANCE IS NECESSARY

'MAINT-INSURE's' **engineering** support includes:

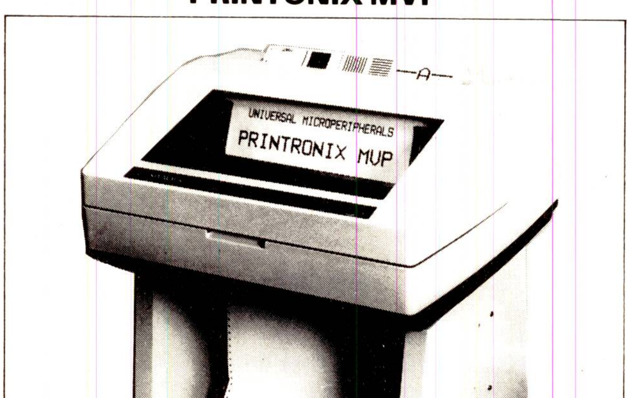
- Response within 24 hours
- Nationwide coverage
- Loaned replacements of defective equipment
- Fully trained experienced Service Engineers
- Full workshop facilities

IN SUMMARY

AS COMPREHENSIVE A SUPPORT SERVICE AS THAT OFFERED UNDER A MAINTENANCE CONTRACT

For further details contact James Beresford Associates, FREEPOST, Curdridge, Southampton SO3 2GJ or ring Botley (04892) 87984

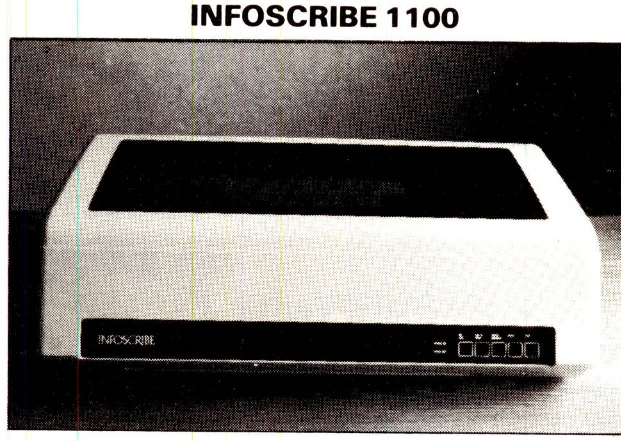
PRINTONIX MVP



MICROCOMPUTER LINE PRINTER

* 200 LPM DRAFT (600 CPS)
* 150 LPM DATA PROCESSING (330 CPS)
* 80 LPM WORD PROCESSING (180 CPS)
* 100% DUTY CYCLE
* BAR CODES, LABEL PROCESSOR
* GRAPHICS
* 140 CHARACTER SETS
* 1 MILLION CHAR/WEEK THROUGHPUT
* ON SITE SERVICE (48hr/24hr/5hr)
* RS232, CENTRONICS STANDARD
* IBM 3270, 3276, 8100, S34/38 INTERFACES

INFOSCRIBE 1100



VERSATILE MATRIX PRINTER

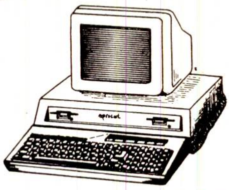
* 200 CPS DATA PROCESSING MODE
* 100 CPS CORRESPONDENCE MODE
* 40 CPS LETTER QUALITY
* QUIET OPERATION LESS THAN 52 Db
* 6 PART COPY
* MULTIPLE FONTS AND PITCHES WITHIN FONTS
* 3.4 KILOBYTE BUFFER
* VERTICAL FORMATTING UNIT FOR FORMS CONTROL
* IBM PC VERSION AVAILABLE
* CENTRONICS AND RS 232C
* MADE IN BRITAIN

TRADE & END USER ENQUIRIES WELCOME

UNIVERSAL MICROPERIPHERALS LTD

THE PRINTER PEOPLE

UNIT 8, KINGSNORTH INDUSTRIAL ESTATE, HOO, ROCHESTER, KENT. TELEPHONE: MEDWAY (0634) 253131.



The Micro System of the Year

For the New Financial Year **ACT Apricot**

Britain's best selling executive microcomputer system, including 256K byte memory, twin 315K byte diskettes, monitor, keyboard, with microscreen **AND** the outstanding **Epson RX80** printer, together with MSDOS, Basic, Supercalc and Super Planner for less than £2,000 excluding VAT.

Complete business system as above together with *Sage executive package* including sales ledger, purchase ledger, nominal ledger, invoicing and stock; **price £2,595 excluding VAT.**

Complete W/P system including Apricot standard software, Juki daisywheel printer and Wordstar with Mailmerge; **price £2,450 excluding VAT.**

Our extensive product range includes Sirius, Sanyo, Epson, Brother, Juki, Microvitec, Sagesoft, Micropro, Microsoft.

Call us for a quotation, or send for our complete list of hardware and software.

CHESTNUT HOUSE LTD
PO Box 12
Liphook
Hampshire
Tel: 0428 714034 (24 hours)

COMPUTER COP-OUTS

1. I can't afford a computer in my business
   — *Wrong! A complete business system, with BBC Computer, Torch Z80 Disc Pack, Monitor, Printer, word processing, database and Sage Accounting System, costs from only £1725*
2. I would find it hard to learn
   — *We provide full training, and the superb Sage Accounts manual tells you everything you need to know*
3. My accounts are in too much of a mess
   — *That's exactly why you need a computer. Get them straight and keep them straight*
4. I haven't time to talk to anyone about it
   — *We're in the centre of Wimbledon, and open all day Saturday*

SOME OF OUR OTHER SUPER PRICES

Torch Z80 800k Disc Pack £650

	£		£
BBC Model B	343	Transtec Krypton	1695
Sirius I	2095	Philips TP200	75
Microvitec Cub	199		
Nordmende TV/Mon	225	Epson RX80 FT	250
Epson RX80	229	JUKI 6100	347
Shinwa CP80	199		
Daisystep 2000	269		

Clare Computing

10 Victoria Crescent, Wimbledon, LONDON SW19 1LG

01-947 8429 Open all day Saturday

All prices exclude VAT & Carriage

WHSMITH

SOFTEAM
BUSINESS SOFTWARE

The Computer User's Dream
– W H SMITH SOFTEAM!

The famous name that plans to be the SINGLE SOURCE for the widest range of Business Software in Britain.

Key reasons for going -WHSMITH SOFTEAM

- You are dealing with a national name you can trust
- We shall be offering the widest range of packages and the best service
- Next day delivery guaranteed throughout mainland U.K. – See the dealers listed in the catalogue.

Here's what to do...

Call in your local WHS store and pick up a catalogue, if they have sold out why not use the form for your annual subscription, and ensure your copy.

W H Smith Softeam Ltd, Euston Road, Freemens Common, Leicester

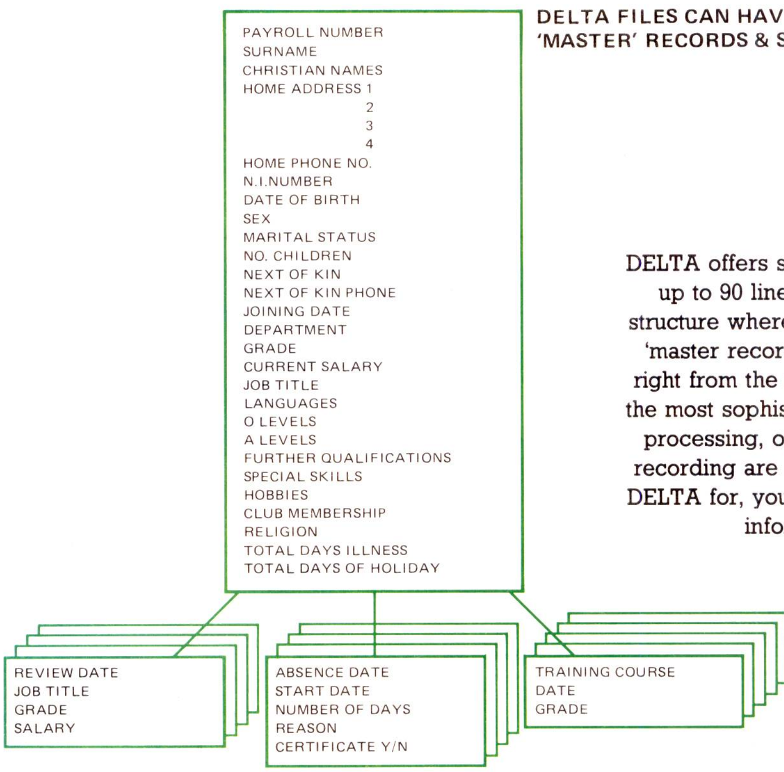
Please send me your latest catalogue and add my name to your circulation list.
W H Smith Softeam, FREEPOST, Leicester LE2 7ZU
Name ____________
Address ____________

A year ago software was nothing like

1984 marks the advent of the new age of database software. The kind of software that executives can really work with – to get the right information at the right time.

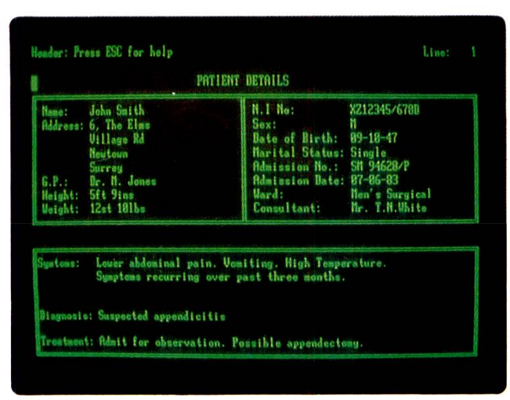
Your staff will really enjoy using DELTA. They'll be able to create their own records, for any one of a thousand myriad uses. Imagine having ALL the vital information about your business stored on disk – from contracts to car fleet records, club records to currency exchanges, customer records to course bookings. Data on file can be added to or amended in seconds, and files searched and sorted at lightning speed. You'll really be able to respond quickly and efficiently to changes in the business world, AND take positive action to maximise on whatever situation develops.

DELTA FILES CAN HAVE 'MASTER' RECORDS & SUB–RECORDS.

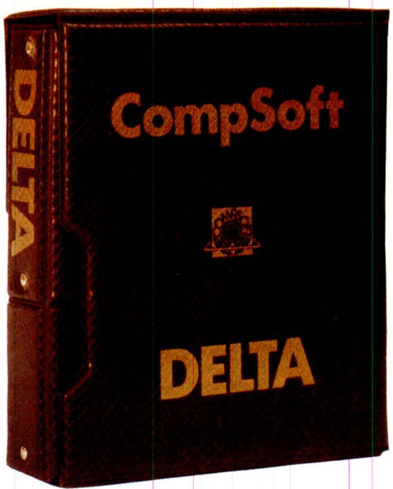


DELTA offers so many powerful functions. Each record can hold up to 90 lines of information, and DELTA has a special file structure where you can attach up to 32,000 sub-records to each 'master record'. This means that DELTA can grow with you – right from the most simple mailing or record system through to the most sophisticated uses of microcomputers. Stock with order processing, or customer invoicing, or personnel and absence recording are all in a days work for DELTA. Whatever you use DELTA for, your datafiles will become an endless source of vital information to help you run your business.

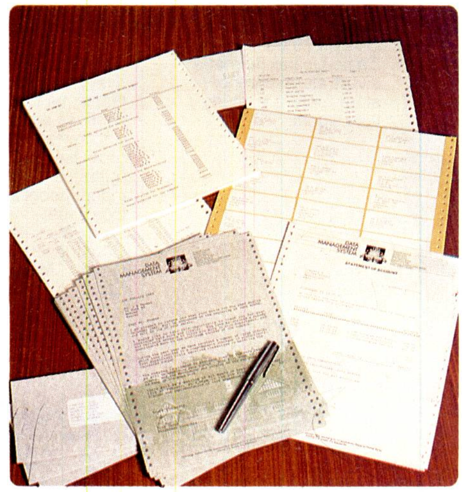
DELTA is available for most microcomputers with the PCDOS, MSDOS or CP/M operating systems, including the IBM PC, SIRIUS, APRICOT, DEC RAINBOW, HP 150, EPSON QX 10, XEROX, etc, etc. DELTA is available in 8 European languages and is also distributed by IBM, DEC and HP.



this..

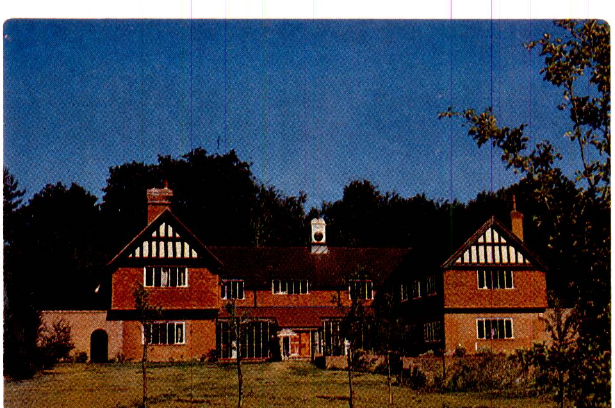


DELTA is truly user friendly. It is designed for busy executives and DP professionals who need to get the job done quickly. DELTA offers powerful sorting and selection capabilities, its own calculation program, PLUS its own report generator to print lists, reports, mailing labels and even personalised letters. DELTA also links with LOTUS 123, Multiplan, Wordstar, and Pegasus. It's the perfect way to make the most of your data.



DELTA PRINTS ALL TYPES OF REPORTS, LISTS, LABELS & PERSONALISED LETTERS.

Unlike any ordinary database, DELTA can be ready to use on the same day that it arrives on your desk. Simply use the question and answer routines to tell DELTA what you want to do – later on you can even write your own menu of options, and hand DELTA over as a complete 'dedicated' system for the job it has to do. DELTA is the modern way to store data – you can confidently regard DELTA as the most comprehensive and sophisticated database on the market today.



COMPSOFT HEADQUARTERS & TRAINING CENTRE.

If you haven't already looked at DELTA now is the time to do so. You can either see it at Compsoft's headquarters near Guildford, or we'll recommend the best local supplier in your area.

Training courses, a Users Club and 'Hotline' service provide a totally professional after-sales backup service

Ring us or return the clip coupon to receive a superb 12 page full colour guide to database software, and a technical summary of DELTA'S main functions. Or chat on the phone to one of our consultants about your own business application. Whatever you do, don't stay in the dark ages about database software – DELTA is your key to success.

COMPSOFT

Compsoft Limited, Hallams Court
Shamley Green, Nr Guildford, Surrey
England GU4 8QZ.
Telephone: Guildford (0483) 898545
Telex: 859210

Please send me further details

Company ....

Contact ....

Address ....

Tel ....

VISA

PCW 7.84

FLOPPY DICK'S® 'N' RIBBONS

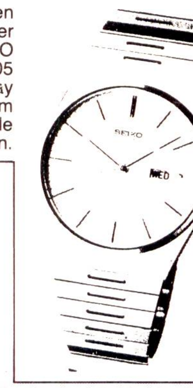
FLOPPY DICK SAYS: "Reward your workers for achievement, or improve company morale by having a raffle, or club together with friends, or treat yourself at OUR expense with these

FREE INTRODUCTORY OFFERS"

FREE CASIO with orders OVER £75.00 Casio-Unisex 50 metre divers alarm/chrono/stopwatch/light hourly time signal.

FREE CASIO TC600 when you buy goods over £199. World's first finger touch sensor calculator with keyboard on glass face at touch of button. 3 independent alarms. Dual time. Stopwatch. Countdown timer. Chrono. Microlight. Etc.

FREE SEIKO when you buy goods over £499. A superb SEIKO QUARTZ SPK005 stainless steel. Day date. Calendar. From Seiko's Profile Collection.



FREE Plastic Library Case with every 10 ATHANA DISKS. Opens out to an easel stand for working access.

maxell (HITACHI) *For maximum reliablity*

With technical specifications unsurpassed by any other manufacturer, Maxell is set to become the world's No. 1 quality media maker. A lifetime guarantee and negligible performance drop-off after 20 million passes, that's MAXELL . . . PERFECTION.

5.25" MINI-DISKS (Box 10)

		1-4	5-9	10+
MD1-D	S/side D/dens 48TPI soft 10 or 16	23.49	22.49	21.49
MD2-D	D/side D/dens 48TPI soft 10 or 16	31.49	30.49	29.49
MD1-DD	S/side Quad 96TPI soft	31.49	30.49	29.49
MD2-DD	D/side Quad 96 TPI soft	41.49	40.49	39.49

8" FLOPPY DISKS (Box 10)

FD1-128	S/side D/dens soft or 32 hard	29.99	27.99	26.99
FD1-XD	S/side D/dens soft or 32 hard	34.99	33.99	32.99
FD2-XD	D/side D/dens soft or 32 hard	39.99	38.99	37.99

DISKDATA

1. ALL PRICES INCLUDE POSTAGE
2. Prices are for boxes of 10 disks and exclude VAT
3. You can pick and mix for quantity discounts
4. 48 tpi disks are suitable for 35 or 40 track operation
5. 96 tpi disks are suitable for 77 or 80 track operation
6. All 5.25" disks come with hub ring reinforcements
7. All tracks are certified error free for single or double density use
6. Unless specified, soft sectored disks will be despatched

DATA CASSETTES (Price Box 10)

MAXELL DC300 exceeds ISO spec. 800BPI certified	£25.99
TDK PC15 personal computer high resolution tape, 15mins	£5.89

ATHANA *For value & performance*

The leading American independent manufacturer who consistently out-performs industry acceptance standards at a real value-for-money price plus 5 year guarantee.

5.25 09 MINI DISKS (Box 10)

		1-4	5-9	10+
475001	S/side S/dens 48 TPI soft	19.99	18.99	17.99
474001	S/side D/dens 48 TPI soft	20.99	19.99	18.99
477501	D/side D/dens 48 TPI soft	25.99	24.99	23.99
487701	S/side Quad 96 TPI soft	26.99	25.99	24.99
478801	D/side Quad 96 TPI soft	33.99	32.99	31.99

8" FLOPPY DISKS (Box 10)

473071	S/side S/dens soft	22.99	21.99	20.99
474071	S/side D/dens soft	25.99	24.99	23.99
473470	D/side D/dens soft	30.99	29.99	28.99

FLOPPY DICK SAYS: "Good judgement comes from experience; experience comes from bad judgement". Our Sales Manager has been in the ribbon industry 15 years and all our ribbons are to the O.E.M.'s specification and are guaranteed.

There is not enough space here to list our complete range of telex, typewriter, word processor and computer ribbons so if you don't see what you need,

CALL LAWRENCE OR JENNY ON 0483 273152

OR send a used ribbon (we need to know your printer model, width and length of ribbon) for a quote. Office hours: 8am to 7pm with 24-hour answering machine. Prices include postage.

MULTISTRIKE RIBBONS (Box 12)

REF			1 Doz	3 Doz	6 Doz	12+ Doz
567 M/S	Diablo Hi-type II	each	£2.00	£1.80	£1.70	£1.65
576 M/S	NEC Sprinwriter		3.80	3.61	3.42	3.23
80029-02	ORIGINAL Qume M/S I		3.22	3.06	2.91	2.58
570 M/S	Compatible QumeI/IBM6240		2.34	2.10	1.89	1.70
83990-01	ORIGINAL Qume M/S II Q/L		2.94	2.80	2.59	2.38
665 M/S	Compatible Qume II Q/L		2.58	2.32	2.10	2.00
83991-01	ORIGINAL Qume M/S III Q/L		3.41	3.29	3.05	2.80
665 M/S	Compatible Qume III Q/L		2.58	2.32	2.10	2.00
83100-01	ORIGINAL Qume M/S IV		6.55	6.34	5.86	5.40
664 M/S	Compatible Qume IV		4.55	4.06	3.50	3.33
666 M/S	Ricoh 1600, Tandy, Toshiba EW100		2.50	2.12	2.03	1.94
575 M/S	Wang A5/2281/5541/5581/6581		2.05	1.84	1.76	1.68
574 M/S	Xerox Big Wheel		3.33	2.83	2.66	2.49
667 M/S	IBM Displaywriter		6.99	6.29	5.97	4.99
562 M/S	IBM 82C Tech III		3.10	2.63	2.40	2.00

PRINTWHEELS (packed 6's)

		1 Doz	3 Doz	6 Doz	12+ Doz
Wang	each	5.50	5.00	4.50	4.09
IBM Displaywriter		14.50	12.80	11.70	10.59
IBM 6240/3730		4.75	4.25	4.00	3.75
Qume/Diablo Plastic		3.35	3.00	2.85	2.40
Diablo metal (packed 1)		25.00	each		

State typestyles required. You can use the makers reference numbers. You can pick 'n' mix with ribbons.

ORDER PROCEDURES: Government, councils, universities, schools, etc. send/phone your order and we will allow 30 days payment terms. If an invoice is needed to raise a cheque, please say.**. All orders will be dispatched within 24 hours.**. REMEMBER — if in any doubt, ask.**. FLOPPY DICK SAYS: "Asking dumb questions is easier than correcting dumb mistakes".

FREE INTRO OFFERS: Please allow 30 days for despatch. We reserve the right to substitute a watch of similar style and value in the event stocks become exhausted.

MEMOREX CORRECTABLE DAISYWHEEL RIBBONS (Box 12)

REF			1 Doz	3 Doz	6 Doz	12+ Doz
661 SC	Brother 390/72/7300 P820C/910C	each	2.78	2.35	2.24	2.13
660 sc	Facit 8000/8100 Addo 180		3.30	3.10	2.78	2.56
572 SC	Olivetti ET201/221/231 Silver Reed EX55		2.40	2.04	1.94	1.84
571	Olympia ES100		2.80	2.20	2.08	1.96
675 SC	Xerox 610/615/620/625/627		2.87	2.33	2.22	2.10
578 SL	Triumph/Adler 1010		3.50	2.99	2.79	2.49

MEMOREX CORRECTABLE GOLFBALL RIBBONS (Box 12)

563 SC	IBM Selectric 82C, Addo, Adler, Facit, Hermes, Imperial, Olympia, Remington, Royal, Silver Reed, Triumph, Brother, Juki (orange) Hi-Yield, each	1.35	1.20	1.06	0.99

MEMOREX LIFT OFF TAPES (Box 12)

581	IBM 82 Tacky (orange), each	0.75	0.69	0.59	0.50
583	IBM 82 Lo-Tack Brother 7200 Olympia ES100 (yellow)				
584	Silver Reed EX55/77 Facit 8000				
586	Hermes				
588	Olivetti ET 231				
600	Xerox 610 (orange)				

NYLON RIBBONS — TWIN SPOOL

GRP REF			1 Doz	3 Doz	6 Doz	12+Doz	Min Order Packs
66	Microline 80 (OK1) Commodore 3022/23	each	1.80	1.49	1.29	1.09	12
87	Microline 84/84A (OKIM84)		3.80	3.49	3.09	2.69	6
52	Centronics 100/300/500 OK1 DP100/124/160		6.20	5.69	5.09	4.49	4
78	Centronics 104		18.10	16.39	14.59	12.79	3
65	Tally 2000 (Mannesman)		5.40	5.09	4.69	4.29	4
83	Tally 3000 (Mannesman)		16.60	15.39	13.99	12.99	4
84	Epson 200/310/320/350		1.20	1.09	0.99	0.89	12

NYLON RIBBONS — CASSETTES

204	Qume I Sprint 3 & 5	each	2.90	2.69	2.49	2.29	5
222	Diablo Hi-Type I (Xerox 800/850)		6.50	5.39	4.19	2.99	10
205	Diablo Hi-Type II		4.00	3.59	3.19	2.79	5
227	Olivetti Matrixcart 800		4.60	4.09	3.59	2.99	12
235A	Tally 1000 Diablo II & 31/32/28		3.90	3.49	3.09	2.69	10
243	Centronics 704		6.99	6.39	5.79	5.09	6
259	NEC Spinwriter		5.50	4.99	4.49	3.89	5
320	Epson MX/FX 100 ERC-08		6.20	5.49	4.89	4.19	4
320R	Epson MX/FX 100 refill		2.69	2.49	2.29	1.99	4
273	Epson MX/FX80		3.60	3.00	2.80	2.50	2
274	Epson ERC 03		3.80	3.69	3.59	3.49	4
299	Olympia ES100		3.30	2.99	2.59	2.19	5
328	Centronics 150 Commodore Pet 8023P		4.90	3.99	3.59	3.29	5
347	Olivetti ET121, 231, TES401		6.30	5.62	5.10	4.59	12
234	Centronics 700 Zip pack Tandy LP2		3.80	3.49	3.29	3.09	10
294	Sharp EL7000 Shinshu Seiki Epson ERC05 Tandy TRS80 calculator		4.10	3.43	2.79	2.49	5

MX COMPUTER SUPPLIES

LOWER BARRIHURST HOUSE
DUNSFOLD ROAD
FREEPOST CRANLEIGH, Tel: (0483) 273152
SURREY GU6 8BR Telex: 859111

Qty Product/Description Price

Total
VAT
Total

Cheques/POs payable to MX

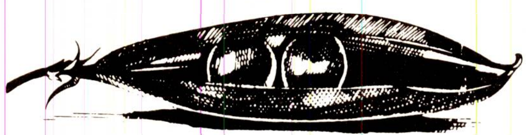
Name ....
Address ....
....
.... Post Code ....
Tel: No. ....
....
Offer Choice ....
Offer valid to June 30, 1984

All our prices include VAT

CRESTMATT

You want more from a computer.

We've got XTRA.



The Compatible Personal Computer

XTRA is the new personal computer from STC Business Systems Limited.

Developed by ITT, the XTRA is operationally compatible with the IBM PC/XT. That's the highest level of compatibility yet achieved.

Which means you can take advantage of virtually all the very latest and best software packages and add-ons.

But the XTRA isn't just a copy cat.

Further positive advantages include a smaller central processor than most comparable systems. And if you're still cramped for desk-space, you can even turn it on its side.

The XTRA also looks better. It has a friendlier keyboard and a screen that tilts and swivels for more comfortable viewing. Even IBM didn't think of that.

All this backed up with excellent training and clear practical instruction manuals.

And we guarantee prompt, efficient installation and after-sales service, too.

Call in for a demonstration.

Once you've seen the XTRA you won't settle for anything less.

128K Computer + 2 Double-sided DD 360K each + monitor + adaptor with **FREE** Juki 6100 (20 cps) Daisywheel Printer — Limited to lifetime of this issue only

£2,419.

XTRA
Personal Computer.
STC AUTHORISED
XTRA DEALER.

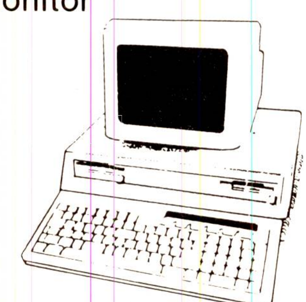
PRINTERS

PRINTERS AND RIBBONS OFFER

MPS 801	£179
Shinwa CP80 + 3 ribbons	£219
Epson RX80FT + 2 ribbons	Call
Epson FX80 + 2 ribbons	Call
CBM 1526 + 2 ribbons	£299
Inforunner Riteman + 2 ribbons	£279
EP44	Call
Canon PW1080A	Call
Brother HR15 + 2 ribbons	£399
Juki 6100 + 3 ribbons	£379
Daisy Step 2000 + 3 ribbons	£329

THE APRICOT

256K, 1 x 315K DD, + Monitor **£1943**
256K, 2 x 315K D/D + Monitor **£2173**
+FREE:



Two years' on-site maintenance contract or Juki 6100 printer, 20 cps daisywheel and full 12-month warranty

Delivery: once cheque cleared within 7 days. Bankers' Drafts, Building Society Cheques, Post Orders 3 days only
Post & packing per item, £4; overnight, £7; software — no charge.
COD £3; for orders above £100 a deposit of £10 is required. Prices subject to change without notice + goods are subject to availability. No Credit Cards.

DEMONSTRATIONS
SALES-SERVICE
SUPPORT

CRESTMATT LIMITED

01-402 1254-5 / 723 4699 / 749 2510 (24 hours)
Telex: 267653 (DRAKE G.).

BEAT THAT

Showroom/Mail order:
67 York Street,
London W1

Head Office:
5th Floor,
Chesham House,
136 Regent Street,
London W1

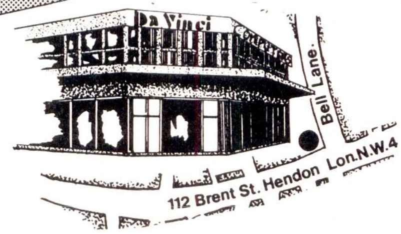
DEALER INQUIRIES
WELCOME
WRITE FOR DETAILS

Da Vinci Computer Store

112 BRENT STREET,
HENDON, NW4
Tel: 01-202 2272/3/4

HELPS PLOT YOUR FUTURE!

Easy parking at rear car park
Nearest tube: Hendon Central
(Northern Line)



OPEN MON-FRI 9.00 – 5.30
SAT 9.30 – 5.00

BUSINESS COMPUTERS –
ALL PRICES OF BUSINESS
MICROS ARE SUBJECT TO VAT @ 15%

BARCLAYCARD VISA

IBM AUTHORISED DEALER — IBM PC

IBM

IBM PC	please call
IBM XT	please call
PC NETWORKING	please call

ACT APRICOT *AUTHORISED DEALER*

apricot

Apricot 256K + 2* 315K Disks	1495
Apricot High Res Monitor (Includes Free Software)	195
New Black Apricot XI 5MC Hard Disk	2695
New Apricot XI 10MG Hard Disk	2995

ACT SIRIUS *AUTHORISED DEALER*

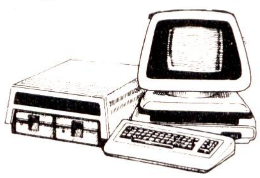
ACT Sirius 1

Sirius 1.2 128K	2195
Sirius 2.4 256K	2895
Sirius SX 10mb 256k	3995
Sirius Network	Please Call

COMMODORE

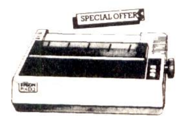
commodore

CBM 8296 SK	795
CBM 8050	895
CBM 8250	895



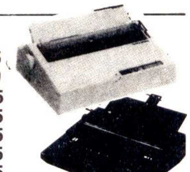
MATRIX PRINTERS

Brother EP44 Typewriter/Printer	220
Epson RX80T	245
Epson RX80FT	265
Epson FX80FT	345
Epson RX100FT	450
Epson FX100FT	475
Epson LQ1500	1100
Printer Buffers from	129



DAISY WHEEL PRINTERS

New Daisy Step 2000 18cps, Qume Compatible	285
Brother CE60 typewriter/Printer 13cps	410
Brother HR15 15cps	445
Brother HR1 18cps	695
Brother HR25 25cps	795
Ricoh Flowriter RP1300 37cps	1245
Rocoh Flowriter RP1600 60cps	1635



SOFTWARE

Pegasus Full Accounts Suite (per module)	295

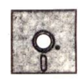
Sales Ledger — Payroll
Purchase Ledger — Stock Control
Nominal Ledger — Job Costing
Invoicing & Sales Order Processing

Superwriter	295
Wordstar	295
Mailmerge	95
Wordcraft (Inc. Mailmerge & Dictionary)	425
Supercalc	195
Multiplan	195
DBase II	395
DMS Delta	495
CSM Incomplete Records (Auditman)	1500
IBIS Incomplete Records (Accounts Prep)	1600
IBIS Time Recording	800
IBIS Bureau Payroll	600
Micromail (Telecom Gold)	95
Special Applications Software	Please Call

PEGASUS BUSINESS SOFTWARE
COMPSOFT
Computer Services Midlands
Dataview
WORDCRAFT

ACCESSORIES

Floppy Disks
Continuous
Stationery
Daisy Wheels
Printer Ribbons
Dust Covers
Disk Storage
Boxes
Disk Cleaning Kits
Battery Backup
Units
Tractor Feeds
Auto Sheet
Feeders
Acoustic Hoods
Computer & Printer
Stands
Cables
Interfaces
Winchester Hard
Disks
Modems
Monitors
Ram Cards
Other



SERVICES

Installation & Training
Software Maintenance
Hardware
Maintenance
Free Demonstrations
Consultancy
After Sales Support
Lease HP or Credit
Cards
Government Contracts
Export Orders

Official Tenders
Educational Discounts
Mail Order
Open 6 Days a Week

Please call for latest second-hand and ex-demo computers and printers

– FREE GAME WITH EVERY COMPUTER WHILE STOCKS LAST

HOME COMPUTERS

ATARI

Atari 600XL	145.00
Atari 800XL	239.00
1050 Disk Drive	289.00
1010 Cassette	49.99

BBC

BBC Model B	389.00
BBC Model B + DFS	469.00
Disk Drives from	180.00
Cassette Units from	25.00

COMMODORE AUTHORISED DEALER

commodore 64

CBM 64	179.00
1541 Disk Drive (+ free software)	199.00
CBM 64SX Portable (+ free software)	£894.99
CBM Cassette	44.95
CBM 801 Printer	199.00
CBM 1526	299.00
CBM Colour Monitor	199.00

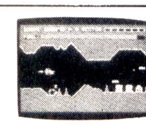
SINCLAIR

sinclair

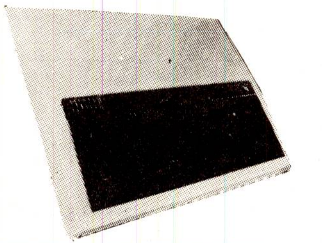
Spectrum 16K	99.95
Spectrum 48K	119.00
Alphacom 32 Printer	59.95

Also, full range of accessories:

Joysticks
Over 1000 Games
Educational
Programs
Printers
Speech
Synthesizers
Word Processing
Data Base
Programs
Spreadsheet
Programs
Sales, Purchase &
Stock Control
Monitors
Computer Desks
Light Rifles
Interfaces
Cables
Disk Drives
Cassette
Recorders
Over 500 Books



BBC Micro Computer System



ACORN COMPUTER SYSTEMS
BBC Model B £348.00a
BBC Model B + Econet £389.00a
BBC Model B + DFS £429.00a
BBC Model B + DFS + Econet £470.00a
6502 2nd Processor £175.00b
Acorn Electron £169.00b
BBC Teletext Receiver £195.00a

UPGRADE KITS
A to B Upgrade Kit £60.00d
DFS Kit £95.00d .... Installation £15.00
Econet Kit £55.00d .... Installation £25.00
Speech Kit £47.00d .... Installation £10.00

BBC FIRMWARE
1.2 Operating System £7.50d
Basic II Rom £32.00d
View Word Processor Rom £52.00c
Wordwise W/P Rom £34.00c
BCPL ROM + Disc £87.00b
Disc Doctor Utility Rom £28.00d
Termi Emulator Rom £28.00d
ULTRACALC Rom (BBC Publications) £65.00c
Gremlin debug Rom £28.00d
Computer Concepts Graphics Rom £28.00d
EXMON £20.00d
TOOL KIT £20.00d
Printmaster Rom (FX80) £28.00d
Communicator Rom £59.00c

BBC COMPATIBLE 5.25" DISC DRIVES:
(All include cables, manual + format disc)
100K (40 Track) Teac £135.00a
100K (40 Track) with psu Tec £145.00a
200K (40/80 Track) Teac £175.00a
200K (80 Track) with psu Tec £190.00a
400K (80 Track DS) Mitsubushi £190.00a
400K (80 TDS) with psu Mitsubushi £225.00a
2×100K (40 Track) with psu Teac £300.00a
2×200K (40/80 Track) with psu Teac £400.00a
2×400K (80 Track DS) with psu Mitsu £420.00a
3" Hitachi 100K Drive £150.00c

Accessories:
Single Disc Cable £6.00d
Double Disc Cable £8.50d
3M DISCS with Lifetime Warranty
40T SS/SD .... Pkt of10 .... £16.00c
40T DS/DD .... Pkt of 10 .... £22.00c
80T SS/DD .... Pkt of 10 .... £26.00c
80T DS/DD .... Pkt of 10 .... £30.00c
3" Double Sided Disc .... Each £4.50c
FLOPPICLENE Drive Head Cleaning Kit £14.50c
Disc Library Case £1.90d
Disc File Case 30/40 .... £8.00c
Disc Lockable Case 30/40 .... £15.00c
Disc Lockable Case 60/70 .... £27.00b

PRINTERS & PLOTTERS
EPSON FX-80 .... £325.00a
EPSON RX-80 FT £250.00a
EPSON FX-100 .... £480.00a
EPSON DX-100 .... £375.00a
Printer Sharer + Cable Set £88.00c
JUKI 6100 Daisy wheel £350.00a
MCP40 Col. Printer/Plotter £110.00a
Accessories:
Parallel Printer Lead £10.00d
Serial Printer Lead £8.00d
Epson Serial Interface 2K 8148 ...... £60.00c
Epson Serial Interface 8143 .... £50.00c
FX80 Dust Cover £4.00d
Epson Paper Roll Holder £17.00c
FX-80 Tractor Attachment £37.00c
PAPER Fanfold 2000 sheets £13.50b
Ribbon MX80/RX80/FX80 .... £6.50c
Gemini Delta 10 .... £300.00a
Grafpad Graphics Tablet £125.00c

CASSETTE RECORDERS
SANYO DR101 Data Recorder £30.00b
Datex Slim Line £20.00c
BBC Tape Recorder £28.50b
Cassette Lead £3.00d
Computer Grade C-12 cassette £0.45d
Computer Grade Cassette 10 off £4.00c
Phillips Mini-data cassette £3.00d

ALL PRICES EXCLUDE VAT
Please add carriage 50p unless indicated as follows:
(a) £8.00 (b) £2.50
(c) £1.50 (d) £1.00

'TIME-WARP'
BBC REAL-TIME-CLOCK/CALENDAR

A low cost unit that opens up the total range of Real-Time applications. With its full battery backup, possibilities include an Electronic Diary automatic document dating precise timing & control in scientific applications, recreational use in games. Its uses are endless and are simply limited by one's imagination. Simply plugs into the user port — no specialist installation required — No ROMS. Supplied with extensive applications software £29.00

U.V. ERASERS

UV1T Eraser with a built-in timer and mains indicator. Built-in safety interlock to avoid accidental exposure to the harmful UV rays. It can handle up to 5 Eproms at a time with an average erasing time of about 20 mins .... £59 + £2 p&p
UV1 as above but without the timer .... £47 + £2 p&p
UV140 up to 14 Eproms £61
UV141 as above but with timer £79

BOOKS

We have a large selection of books on the BBC and other titles. Please ask for details. No VAT on books.

SMARTMOUTH

The original 'infinite speech'. Still the best.

A ready built totally self contained speech sythesiser unit, attractively packaged with built-in speaker, AUX output socket etc — no installation problems! It allows the creation of any English word, with both ease and simplicity, while, at the same time being very economical in memory usage. You can easily add speech to most existing programs. Due to its remarkable infinite vocabulary, its uses spread throughout the whole spectrum of computer applications — these include industrial, commercial, educational, scientific, recreational etc. No specialist installation — no need to open your computer, simply plugs into the user port — and due to the simple software, no ROMS are needed. SMARTMOUTH is supplied with demo and developed programs on cassette, and full software instructions ..... **£37 + £2.50 carriage**

TORCH Z80 DISC PACK

The proven upgrade for the BBC Micro. Comprising 2 x 400K disc drive, Z80 processor with 64K of memory, and a CP/M compatible operating system, it opens up the vast range of CP/M software, including advanced languages, scientific and business applications. The system is supplied complete with the PERFECT software range including PERFECT WRITER, PERFECT SPELLER, PERFECT CALC, and PERFECT FILE. Full TORCHNET software is also supplied allowing sophisticated networking between other units. This will allow access to information, and communication, between up to 254 suitably upgraded BBCs.

NEW TORCH Z80 PACK PRICE £699
SOFTWARE PACKAGE INCLUDES Z80 BASIC

Phone for details about the 20Mbyte Hard Disc Pack, and the 68000 Hard Disc Pack with UNIX Operating System.

NOW AVAILABLE — The TORCH Z80 SECOND PROCESSOR CARD — for those who already have suitable disc drives. The card is supplied with all the free perfect software and Z80 basic, as detailed above, presenting a very attractive package £299
Torch ZH0 240 Mbyte Hard Disc + 400K Floppy £1995a

BBC EPROM PROGRAMMER

A fully self-contained Eprom programmer with its own power supply, able to program 2516, 2716/32/32A/64/128 single rail Eproms.

- ★ Personality selection is simplified by a single rotary switch.
- ★ Programming voltage selector switch is provided with a safe position.
- ★ Warning indicator to show programming in progress.
- ★ Programmer can read, blank check, program and verify at any address/addresses on the EPROM.
- ★ Simple menu driven software supplied on cassette (tranferable to disc).
- ★ Full editor with ASCII disassembler.

Programmer complete with cables, software and operating instructions .... £89 + £2 p&p

MONITORS

COLOUR/GREEN MONITORS (leads incld)
Microvitec 1431 14" RGB Std Res £179.00a
Microvitec 1431PS 14" RGB/PAL + Sound £225.00a
Microvitec 1451 14" RGB Med Res £295.00a
Microvitec 1441 14" RGB Hi Res £420.00a
Microvitec 2031 20" RGB Std Res £287.00a
KAGA Vision Ex 12" RGB £195.00a
KAGA Vision II Hi Res £260.00a
KAGA Vision III 12" RGB Super Hi Res £358.00a
KAGA 12" Green Hi Res £106.00a
SANYO DM8112CX 12" Green Hi Res £99.00a
KAGA RGB Lead £6.50d
BNC Green Screen Monitor Lead £3.00d

ACORN IEEE INTERFACE

A full implementation of the IEEE-488 standard, providing computer control of compatible scientific & technical equipment, at a lower price than other systems. Typical applications are in experimental work in academic and industrial laboratories. The interface can support a network of up to 14 other compatible devices, and would typically link several items of test equipment allowing them to run with the optimum of efficiency. The IEEE Filing System ROM is supplied £282

CONNECTOR SYSTEMS

I.D. CONNECTORS

(Speed Block Type)

	St. Pin	Recep-tacles	Edge Conn.
10 way	90p	85p	120p
20 way	145p	125p	195p
26 way	175p	150p	240p
34 way	200p	160p	320p
40 way	220p	190p	340p
50 way	235p	200p	390p

JUMPER LEADS

24" Ribbon Cable with Headers

	14pin	16pin	24pin	40pin
Single End	145p	165p	240p	380p
Double End	210p	230p	345p	540p

Ribbon Cable with Sockets

	20 pin	26 pin	34 pin	40 pin
1 end	160p	200p	280p	300p
2 ends	290p	370p	480p	525p

AMPHENOL CONNECTORS

36 way plug Centronics
Solder £5.25 IDC £5.25
36 way socket Centronics
Solder £5.50 IDC £5.50
24 way plug IEEE
Solder £5.00 IDC £4.75
24 way socket IEEE
Solder £5.00 IDC £4.75
PCB Mtg Skt Ang pin
24 way £6.00 36 way £6.50

RIBBON CABLE

(Grey/meter)

10 way	40p
16 way	60p
20 way	85p
26 way	120p
34 way	160p
40 way	180p
50 way	200p
64 way	280p

D CONNECTORS

	No. of Ways			
MALE				
Solder	80p	105p	160p	250p
Angled	150p	210p	250p	365p
FEMALE				
Solder	105p	160p	200p	355p
Angled	165p	215p	290p	440p
Hoods	90p	85p	90p	100p

IDC 15 way Plug 340p Socket 400p
IDC 25 way plug 385p Socket 450p

TEST CLIPS

14 pin 375p 16 pin 400p
40 pin £10.30

RS 232 CONNS

(25 way D)
24" Single end Male £5
24" Single end Female £5.25
24" Female-Female £10
24" Male-Male £9.50
24" Male-Female £9.50

DIP HEADERS

	Solder Type	IDC Type
14 pin	40p	120p
16 pin	50p	140p
24 pin	100p	200p
40 pin	200p	225p

EUROCONNECTORS

DIN 41617	PLUG	SKT
21 way	160p	165p
31 way	170p	170p

DIN 41612		
2 x 32 way St Pin	230p	275p
2 x 32 way Ang Pin	275p	320p
3 x 32 way St Pin	260p	300p
3 x 32 way Ang Pin	375p	400p
1 DC Skt A + B	275p	
A + C	350p	

For 2 x 32 way please specify spacing (A + B, A + C)

EDGE CONNECTORS

	0.1"	0.156"
2 x 6 way (Commodore)	—	300p
2 x 10 way (Commodore)	150p	—
2 x 12 way (Vic 20)	—	350p
2 x 18 way	—	140p
2 x 23 way (ZX81)	175p	220p
2 x 25 way	225p	220p
2 x 28 way (Spectrum)	200p	—
2 x 36 way	250p	—
1 x 43 way	260p	—
2 x 22 way	190p	—
2 x 43 way	395p	—
1 x 77 way	400p	500p
2 x 50 way (S100conn)	600p	—

COMPONENTS

TEXTOOL ZIF SOCKETS

2532	350p
2732	350p
2764-25	500p
27128-3	£15.00
4164-2	450p

DIL SWITCHES

4 way	70p
6 way	100p
8 way	130p
10 way	150p

BAUD RATE GENERATORS

MC14411	900p
COM8116	800p
4702B	750p

CPUs

1802CE	650p
2650A	£12
6502	400p
6502A	650p
6800	290p
6802	300p
6809	650p
6809E	£12
68B09	£12
68B09E	£16
68000-L8	£48
8035	550p
8039	550p
8080A	350p
8085A	£18
8086	£22
8088	£22
8748	£36
TMS 1601	£12
TMS9980	£12
TMS9995	£12
WD55	£14.50
Z80	300p
Z80A	400p
Z80B	9.50

SUPPORT DEVICES

2651	£12
6520	300p
6522	350p
6532	650p
6551	650p
6821	200p
68B21	250p
6854	85p
68B54	£12
6875	750p
8205	225p
8212	300p
8216	200p
8224	200p
8250	£11.50
8251A	£18
8255AC-5	£19
8256	£36
8279	750p
8288	£11
Z80P10	300p
Z80AP10	350p
Z80CTC	300p
Z80ACTC	280p
Z80DART	700p
Z80ADART	850p
Z80ACTC	350p
Z80AS10-0/2/9	900p
TMS9901	500p
TMS9903	£25
TMS9911	£18
TMS5220	£12
Z80AS10-0/1/2/9	900p

CRT CONTROLLER

CRT6545	900p
CRT5027	£18
CRT5037	£18
EF9365	£36
EF9366	£36
6845	650p
6847	650p
TMS9927	£18
TMS9928	£20
TMS9929	£16
MC6845SP	750p
SFF96364	800p

TECHNOMATIC LTD

MAIL ORDERS TO: 17 BURNLEY ROAD, LONDON NW10 1ED
SHOPS AT: 17 BURNLEY ROAD, LONDON NW10
(Tel: 01-452 1500, 01-450 6597. Telex: 922800)
305 EDGWARE ROAD, LONDON W2

PLEASE ADD 50p p&p & 15% VAT
(Export: no VAT, p&p at Cost)
Orders from Government Depts. & Colleges etc. welcome.
Detailed Price List on request
Stock items are normally by return of post

DISKS DISKS DISKS

★★★ LOWEST PRICES – FAST DELIVERY ★★★

PRICE PROMISE

We will Better any lower delivered price advertised in the current issue of PCW. Please Telephone

DYSAN 5.25" DISKS — BOXES OF 10

			Prices per Box (£) 1-4	5-9	10-49	QTY	AMOUNT
104/1	S/side S Dens	48tpi 40Tr	18.00	17.00	16.00		
104/1D	S/side D Dens	48tpi 40Tr	20.00	19.00	18.00		
104/2D	D/side D Dens	48tpi 40Tr	28.00	27.00	26.00		
204/1D	S/side Q Dens	96tpi 80Tr	28.00	27.00	26.00		
204/2D	D/side Q Dens	96tpi 80Tr	34.00	33.00	32.00		
VERBATIM DATALIFE (Five year warranty)							
MD525-01-HR	S/side S or D Dens	48tpi 40Tr	15.25	15.00	14.50		
MD550-01-HR	D/side S or D Dens	48tpi 40Tr	21.50	20.75	19.50		
MD577-01-HR	S/side D or Q Dens	96tpi 77/80Tr	22.00	21.25	20.00		
MD557-01-HR	D/side D or Q Dens	96tpi 77/80Tr	28.00	27.25	26.00		

10 or 16 hard sectors at same price.
Add £1.00 for Plastic Case
Free H/Cleankit worth £6.40 with every box while stocks last.

VERBATIM VEREX (One year warranty)							
MD200-01	Soft Sector uninitialised		14.25	13.75	13.25		
MEMOREX							
3431-HR	S/side S Dens	48tpi 40Tr	14.50	14.25	13.75		
3481-HR	S/side D Dens	48tpi 40Tr	14.80	14.50	14.00		
3491-HR	D/side D Dens	48tpi 40Tr	20.50	19.75	19.00		
3504-HR	S/side Q Dens	96tpi 80Tr	23.00	22.25	21.50		
3501-HR	D/side Q Dens	96tpi 80Tr	25.00	24.25	23.25		
BASF (Qualimetric) — Special Offer							
1X	S/side S Dens	48tpi 40Tr	14.60	14.20	13.80		
1D	S/side D Dens	48tpi 40Tr	18.30	17.75	17.20		
2D	D/side D Dens	48tpi 40Tr	21.50	20.75	19.50		
ACCESSORIES							
HCK5	Head Clean Kit with Fluid		14.90	14.50	14.00		
LC5	5.25 Library cases EGLY		1.90	1.80	1.70		
LB40-5	Lockable Box 40 Cap inc Disk Pen		13.50	13.00	12.50		
LB85-5	Lockable Box 85 Cap inc Disk Pen		16.50	16.00	15.50		
VCK-5	Verbatim 5 in Head clean kit		6.40	6.20	6.00		
VCD-5	Verbatim 5 in H/c disks (per 10)		12.50	12.30	12.10		
LB20-5	Compact Ring Binder 20 Cap		4.25	4.00	3.75		
SONY 3.5" DISKS			37.00	36.00	35.00		

8" DISKS — BOXES OF 10

Phone for most Competitive Prices for Verbatim, BASF, Memorex, etc.

POSTAGE/PACKING (UK)

5·25 Disks/Clean Kit	£1/Box* (75p/Box 5+, 50p/Box 10+)	p & p
Library Case	50p/Box (35p/Box 5+, 25p/Box 10+)	Total Exc. VAT
Lockable Box	£2.50/Box (£2/Box 5+, £1/Box 10+)	VAT 15%
		Total Payable

*Add 30p/Box for 1st Class

Please contact us for Quantity Discounts (50 + Box) and Trade Accounts.
Official orders accepted from Government and Educational Establishments.

Name .... Tel. No. ....

Address ....

....

Access/Barclaycard/Cheque No ....

If you do not wish to cut out form send order separately

34 Cannonbury Avenue, Pinner, Middx HA5 1TS

Telephone orders any time – we do the rest – 01-868 9548

Pinner Wordpro

Top savings on Floppy Disks
FAST MAIL ORDER SERVICE

VERBATIM (World Market Leaders)

* *Datalife 5 year warrenty*
* *All tracks certified 100% error free*
* *All International Standards met or exceeded*

All products are brand new and fully guaranteed

5¼" Diskettes	price for box of 10: 1-9	10-49	50-99	quantity	amount
MD 525 S/S 48 tpi	15.96	15.05	14.50		
MD 550 D/S 48 tpi	22.50	21.25	20.00		
MD 577 S/S 96 tpi	22.50	21.25	20.00		
MD 557 D/S 96 tpi	28.00	27.25	26.00		
8" Diskettes					
FD 34 9000 S/SS/Den	24.99	23.99	22.99		
FD 34 8000 S/SD/Den	24.99	23.99	22.99		
DYSAN (High Quality)					
5¼" Diskettes					
104/1DS/S 48 tpi	21.50	21.00	19.50		
104/2DD/S 48 tpi	29.50	29.00	28.00		
204/1DS/S 96 tpi	30.60	29.00	28.00		
204/2DD/S 96 tpi	36.00	35.50	35.00		
8" Diskettes					
3740/1S/S S/D	28.50	27.50	26.50		
3740/1D S/S D/D	30.90	29.90	28.90		
3740/2D D/S D/D	28.90	37.90	36.90		

48 tpi suitable for 35 or 40 track
96 tpi suitable for 77 or 80 track
10 and 16 Hard Sector at same price

CUMANA 5¼" Disk Drives: Fully Compatible with BBC Cased and Guaranteed for 1 year

Single Units	
CS100 40 Track S/S 100k	£169.00
CS200 80 Track S/S 200k	£210.00
CS400 80 Track D/S 400k	£259.00
Twin Units	
CD200 2x40 Track S/S 200k	£319.00
CD400 2x80 Track S/S 400k	£365.00
CD800 2x80 Track D/S 800k	£425.00
Dual Switchable Unit	
CD400S 40 or 80 Track 400k	£449.00
CD800S 40 or 80 Track 800k	£465.00

Please contact us for quantity discount 100 + Boxes.
Account facility available to approved customers.
Official order accepted from Government & Educational Establishments

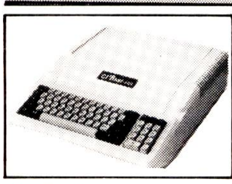
Total Exc VAT	
Postage	.75p
VAT 15%	
Total Payable	

S. S. STATIONERS & COMPUTER SUPPLIES
Computer Ribbons, Cleaning Kits, Computer Furniture and Commercial Stationery
43 BURNT OAK BROADWAY, EDGWARE MIDDLESEX HA8 5JZ
TELEPHONE: 01-205 3447

NAME: ____________
ADDRESS: ____________
TEL: ____________

· VALUE · VALUE · VALUE ·

APPLE COMPATIBLE PRODUCTS



STAGGERING VALUE AT
£319.00 *+£47.85 VAT*

BASE 64A compatible with Apple cards and software. Equivalent to Apple-II plus with extra 16K and new Autostart Monitor. Additional features include ROM based system control program, 64K on board memory, expandable to 192K. MINI-WRITER on board in ROM. 24K system memory. Tiny assembler with assembly and disassembly function. Upper/lower case. Function commands on keyboard. Numerical and cursor keypad. Can load 140K diskette program to 192K user RAM.

ADD-ONS

80A COLUMN CARD CPA 4
£57.50 + £8.62 VAT

Z80 CARD CPA 3
£47.90 + £7.19 VAT

128K RAM CARD CPA 20
£199.00 + £29.85 VAT

16K RAM LANGUAGE CARD CPA 1
£57.50 + £8.62 VAT

FORTH CARD CPA 2
£57.50 + £8.62 VAT

INTEGER CARD CPA 2A
£57.50 + £8.62 VAT

EPROM PROGRAMMER CARD CPA 5
£57.50 + £8.62 VAT

PAL CARD CPA 7
£57.50 + £8.62 VAT

PRINTER INTERFACE CARD CPA 9
£38.32 + £5.75 VAT

RS 232 CARD CPA 12
£57.50 + £8.62 VAT

DISK DRIVE INTERFACE CARD CPA 6
£47.90 + £7.19 VAT

DISK DRIVE CPA 14
£139.00 + £20.85 VAT

JOYSTICK CPA 15
£12.00 + £1.80 VAT

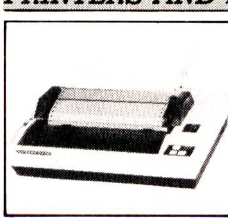
TURNKEY OFFERS

Base 64 unit with monitor, two slim line disk drives and disk controller card:
£715.00 + £107.25 VAT

Base 64 unit with monitor, two slim line disk drives and controller card, Z80 card and 80 column card, CP80 printer and controller:
£1040.00 + £156.00 VAT

PC 301 with colour monitor
£1650.00 + £247.50 VAT

PRINTERS AND MONITORS



CP80 DOT MATRIX PRINTER 80 CPS
£189.00 + £28.35 VAT

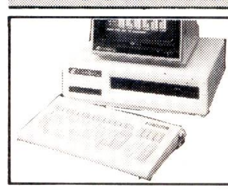
RITEMAN SLIM PRINTER 120 CPS
£229.00 + £34.35 VAT

AMBER MONITOR
P.O.A.

PHILIPS V7001 12" GREEN MONITOR
£75.00 + £11.25 VAT

Various monitors — colour, monochrome and amber; and printers can be supplied to order at very competitive prices.

IBM COMPATIBLE PRODUCTS



WE HAVE TAKEN A BYTE OUT OF THE PRICE!
£1450.00 *+£217.50 VAT*

Not dissimilar to IBM PC, includes 2 × 320K double sided disk drives. Colour video board and 128K multifunction card, expandable to 256K, with serial port, parallel port and clock/calendar. PC 301 includes five expansion slots, keyboard and MS DOS 210.

DEALER ENQUIRIES

We are main distributors for the Base 64A and the PC 301. Dealer enquiries are welcome.

TO ORDER

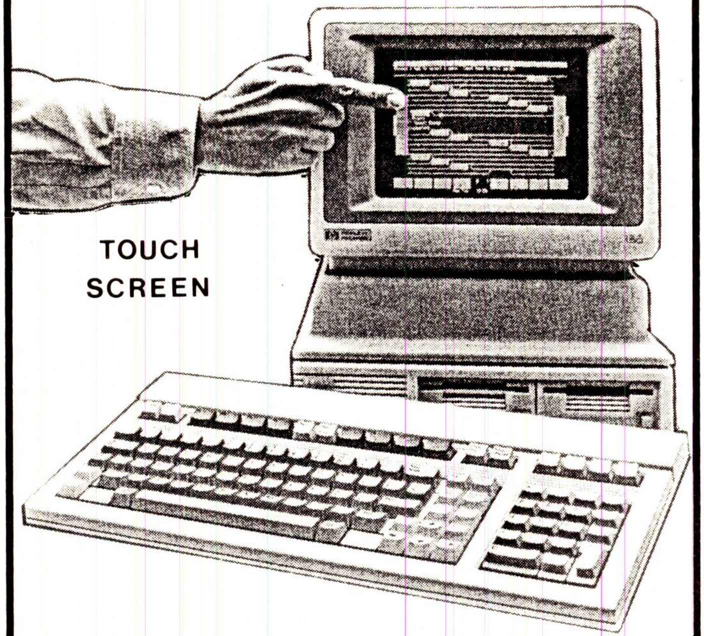
Please telephone order particulars to 01-930 5061 or visit our West End Offices at 102 Jermyn Street, London SW1Y 6EE.

101/102 JERMYN STREET, LONDON SW1Y 6EE · TELEPHONE: 01-930 5061

· WOLFCROWN ·

CONCEPT

COMPUTERS LIMITED



TOUCH SCREEN

HEWLETT PACKARD

HP 150

The Finishing TOUCH To Your Business

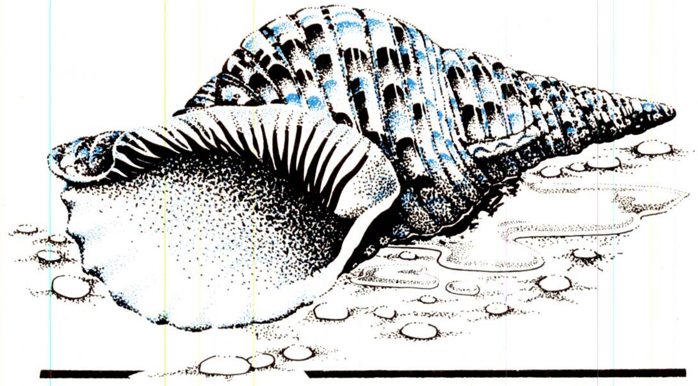
Switch on... you're productive

Learning time on the HP 150 is close to zero. You won't have to work through tedious tutorials, wrestle with frustrating manuals. Just touch the screen at the appropriate place . . . your HP 150 executes your wishes.

Call us now to arrange a demonstration.

47 Holborn Viaduct, London. EC1N 2PB

Tel: 01-729 1800



A FEW WORDS IN YOUR SHELL

BEWILDERED BY BUZZ-WORDS?
CONFUSED BY THE CHOICE?
PUZZLED BY PERIPHERALS?

Then contact FORCE 4 and get our friendly and expert help

Need a faster, more versatile matrix printer for your IBM PC?
—Call FORCE 4

What about a dual-role printer, with correspondence-quality printing plus the speed of a matrix machine?
—Call FORCE 4

Want a medium or high resolution colour monitor for your Micro, including the IBM PC?
—Call FORCE 4

Do you need a fully-featured VDU with lots of popular emulations?
—Call FORCE 4

High capacity disk system for the IBM PC? What about 26 Mbytes Fixed plus 26 Mbytes Exchangeable, using an ANSI 8" cartridge—fully compatible with existing software?
—Call FORCE 4

Have you been seeking a good low-cost colour printer thats really quiet?
—Call FORCE 4

Have you been looking for a supplier with comprehensive workshop facilities who will give really effective back-up?
—Call FORCE 4

These are some of the famous names whose products we supply and support with a FULL 1 YEAR WARRANTY:

Amcodyne, Canon, Deccacolour, Dyneer, Epson, Fidelity, Hazeltine, Integrex, OKI, Sanyo, Seiko Silver Reed & Tatung.

Got a peripheral or accessories problem?
Call FORCE 4

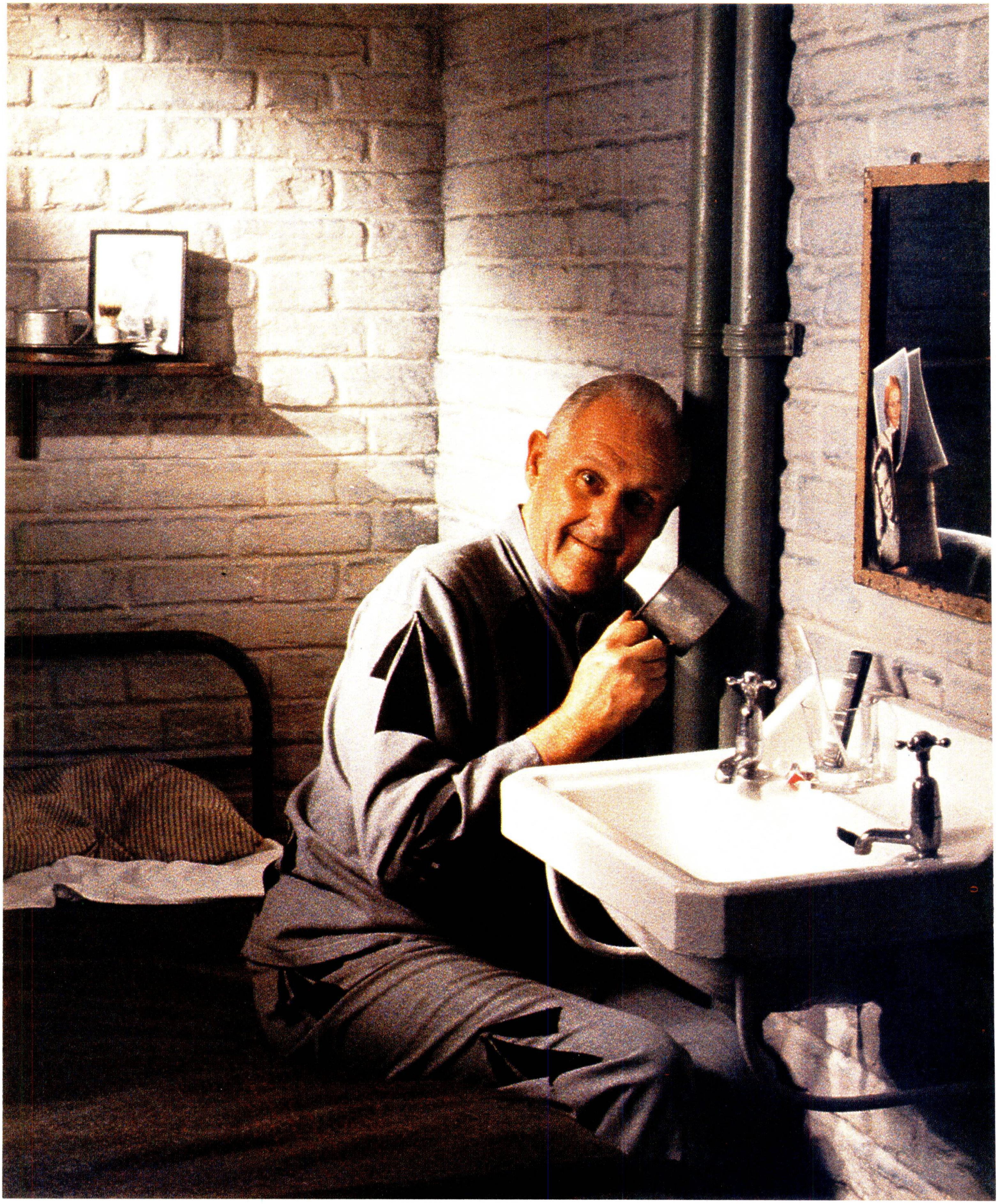
A FORCE TO BE RECKONED WITH

Force 4 Computer Services Limited
Victory House
Somers Road North
Portsmouth
PO1 1PJ
Telephone: (0705) 839135
Telex: 858902 BARON-G

FORCE 4

FF 3813 84

AT LAST, THE MIC
RELEASED FROM SOI



ROCOMPUTER IS
TARY CONFINEMENT

A business thrives on the free flow of information. Accounts, production control and sales staff invariably need access to the same data.

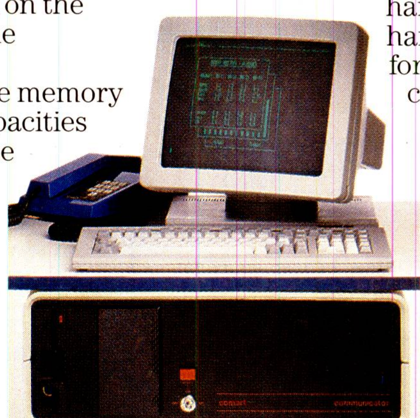
The microcomputer was supposed to enhance this process by making it faster, more accurate and more efficient.

By an odd quirk, however, many microcomputer users lose their freedom to exchange information. By acquiring inflexible 'stand alone' systems they, in effect, put their information into solitary confinement.

The astonishing success of Comart Communicator multi-user systems is largely because they *don't* imprison you in this way and allow you to share computer power and performance among all the key members of your staff.

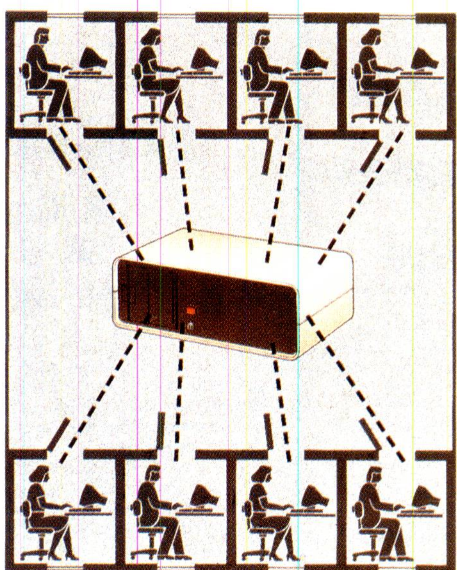
To be specific, up to nine users can share the same processing unit and data storage facilities whilst making economic use of expensive peripherals such as printers, plotters and tape back-up units. Each extra user shares access to the system merely by the addition of a simple VDU and keyboard. All of which represents a big saving over buying a complete computer for each.

The Communicator range of 15 models provides everything you could want in a microcomputer system. Depending on the number of users, the complexity of your applications and the memory size and storage capacities required, you can be assured of finding precisely the system you need – and pay only for that. The Communicator now comes with the new Intel 286 powerhouse 32-bit processor as well as the established 8 and 16 bit models. There's also a choice of memory from 64K-1Mb and of storage capacities on floppy disks or 5, 20 or 40Mb integral Winchester disk drives.



The great difference with the Communicator range, of course, is its modular design.

You can stay right up with the latest technologies or expand and upgrade your current systems, simply with the change of a circuit board or two. Add-on modules can also provide additional storage and back-up. The Communicator's modularity ensures your investment is safe, because when in the future you decide you want to share computer power with more users, you can simply expand your system without writing off the cost and starting all over again.



From 1-9 users can share a Communicator 'multi-user' system.

It may not surprise you to know that the Communicator hardware is among the hardest around, working for thousands of prudent companies worldwide – and having met the stringent requirements of the CCTA – that includes the Government.

But however tough the hardware, it's the software which enables you to use it, so it's good to know that the Communicator gives you access to all the business and commercial standards such as Word Processing, Financial Planning, Accounting Suites, Database Management and Stock Control, plus communications to IBM and ICL mainframes. And also far beyond with specialist suppliers providing 'industry-specific' software.

As a nice bonus, Communicators also come with the very latest operating systems, including Digital Research's multi-user Concurrent CP/M which enables you to switch from up to four programs simultaneously so your secretary won't have to clear the screen or save work on disk when you need an urgent report updated or a fast printout.

And it might interest you to know that the other chap in Cambridge isn't the only one batting for Britain. We're British too and one of the longest-established computer manufacturers around. This has the practical advantages of better service for our customers through a nationwide network of specialist dealers plus the maintenance back-up of our 'Microserve' organisation.

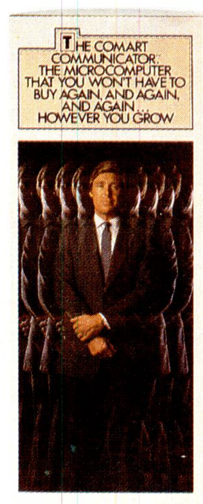
When you choose from the Communicator range you go for the freedom to extend the benefits of a microcomputer system throughout your business. One that will protect your investment, grow as you grow, and never grow old.

Ask us for the key – send for our colour brochure and we'll also give you details of your nearest Communicator dealer.

comart

Comart Computers Limited, Little End Road, Eaton Socon, St. Neots, Huntingdon, Cambridgeshire PE19 3JG
Tel: (0480) 215005 International +44 – 480 – 215005 Telex: 32514 Comart G

A member of the Comart Group of Companies



THE MICRO THAT'S GOT PEOPLE TALKING

Name: ______________________

Company: ______________________

Position: ______________ Tel: ______________

Address: ______________________

____

All products referred to are trademarks or registered trademarks of the companies of origin.

spectrum

The Latest NEWS from Spectrum

Get Your Copy of

MICRO UPDATE

Spectrum's own magazine from your local Spectrum dealer Now! All the info on the very latest in home micros and add-on's for your computer.

WIN! a super VIP day at **SILVERSTONE** with **SPECTRUM** and **ACORN**

On August Bank holiday August 27th

There's a Super competition starting NOW at SPECTRUM-arranged in conjunction with ACORN Computers, there are Two prizes for two people each of a Fabulous all expenses paid day out at Silverstone Races.

Pick up an entry form from your local Spectrum dealer Now!

No Purchase Required

ACORN ELECTRON

The new Computer from Acorn. Using the same powerful BBC basic as the BBC B. The Electron is the ideal machine for learning about computers as most schools use BBC BASIC. It also features a full qwerty keyboard with the ability to enter command's with one keystroke, and gives high quality graphics output to either colour T.V. or monitor. Sound can be generated through the internal speaker.

£199.00

COMPUTER DEALERS

or prospective dealers. If you would like to know more about becoming a SPECTRUM APPOINTED DEALER on an exclusive area basis please write to: MIKE STERN or DUDLEY LANGMEAD Spectrum UK Ltd, Burrowfield, Welwyn Garden City, Herts or Telephone (07073) 34761

LATEST NEWS

- For up-to-date news, information & offers from SPECTRUM - see PRESTEL page 600181 for details.

UP TO £1000 INSTANT CREDIT,

spectrum CHARGE CARD

- There's up to £1,000 worth of Instant Credit available on a Spectrum Chargecard. See your local SPECTRUM dealer for written details (UK mainland only) Typical APR -29.8%

BBC Model B

Including FREE!

- Cassette Recorder and
- 5 pieces of Software

When you buy a BBC 'B' from Spectrum!

The BBC MODEL B, probably the most flexible personal microcomputer available today. Using powerful BBC BASIC, the BBC B is widely accepted as providing the educational standard for computer learning.

The model B features a variety of interface ports allowing easy connection not just of ordinary peripherals but also second processors or devices to give access to teletext or prestel services.

SPECTRUM PRICE **£399**

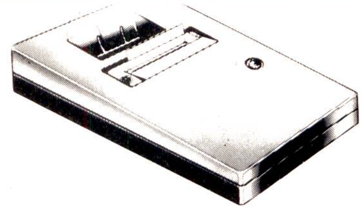
OPUS DISC DRIVE

for BBC Model 'B'

SPECTRUM LOW PRICE **£189**

Including: Manual and Utilities Disc

BIT PRINTER



An expensive quality printer for the BBC 'B'?. Just look at our fantastic low price on this super Dot Matrix printer! The ideal machine for the home user, the Bit Printer combines practicality with low cost -now you can list programs for debugging without spending a three-figure sum. The Bit Printer interfaces directly with the BBC 'B'. See it at Spectrum now!

SPECTRUM LOW PRICE **£89.95**

ACCESSORIES for BBC

BBC Dual Disk Drive	£750.00
BBC BUGGY	£189.00
RC DIGITAL TRACER for the BBC	£55.50
GRAF PAD Graphics Tablet	£143.75
PROLINK Joystick Interface	£9.95
BIT-PRINT ZX Printer	£89.95
BBC Single Disc Drive	£265.00
BBC Disk Interface Kit (inc. fitting)	£97.00
Acorn Software Cassette-Based from	£9.95
Acorn Disk-Based software	£11.50
BBC Disk-Based software from	£9.95
BBC BUGGY Spectrum Price	£189.00
BBC Disk Manual & Utilities Disc	£34.50
QUICK-SHOT JOYSTICK Especially for the BBC - Spectrum Price	£19.95

Spectrum Computer Centres have no connection whatsoever with the ZX-Spectrum Computer manufactured by Sinclair Research Ltd.

Now from Spectrum - a complete business computer system for under £900

COMMODORE 64

BUSINESS PACKAGE

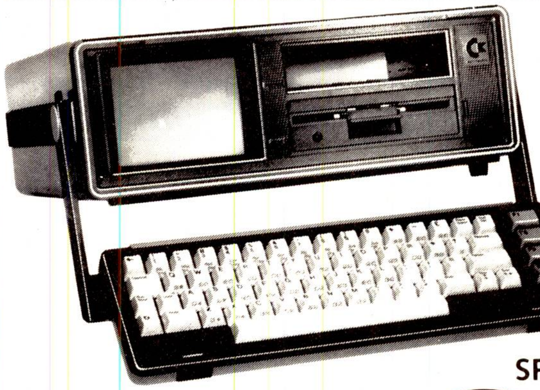
■ Extremely simple to use - no computer experience required ■ Complete & ready to run with Sales/Invoicing & purchase ledger programs. ■ Complete end-of-month reports at the touch of a button - including Creditors/Debtors lists Sales & cash lists, statements, VAT balances etc.

Includes ■ COMMODORE 64 ■ DISK DRIVE ■ COLOUR MONITOR ■ COMMODORE PRINTER ■ PURCHASE LEDGER PROGRAM ■ SALES LEDGER PROGRAM ■ EASY SCRIPT PROGRAM Plus! ■ FREE! GAMES DISK WITH SIX GAMES

FROM ONLY

£899.95 WITH MPS801 Printer

Just Arriving! It's the new, superb COMMODORE SX64 PORTABLE



BIG NEWS from Spectrum - stocks are just arriving of the incredible new Commodore SX 64 Portable Colour Computer - a dream come true for the travelling executive! This superb, compact Micro incorporates all of the top-selling Commodore 64's functions, and features a detachable, full function keyboard plus built-in colour monitor AND single disk drive. We're very excited - you can see it at your local Spectrum dealer now!

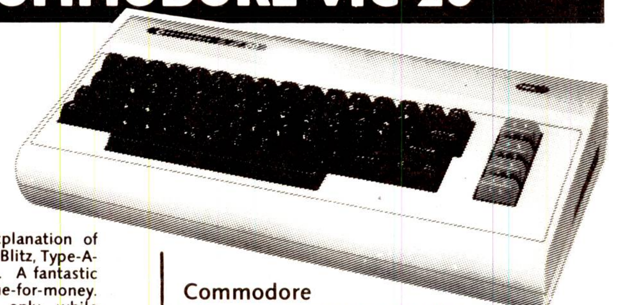
FREE! FREE! FREE!

● FREE with each SX64 Portable three superb programs - Easy Script, Future Finance and Easy Stock.

SPECTRUM PRICE

£895

COMMODORE VIC-20



Super Value!

STARTER PACK

A complete Home Computer system including the VIC-20 Computer, a Cassette Unit, introduction to BASIC part 1 -a simple explanation of computer programs - Blitz, Type-A-Tune, Race & Hoppit. A fantastic deal!! and great value-for-money. But HURRY! offer only while stocks last.

SPECTRUM PRICE

£139.99

Also available

VIC-20

Spectrum Price

£99.95

Including: 4 FREE ROM GAMES WORTH **£39.96**

Commodore VIC-20, SOFTWARE PACKS at HALF PRICE

● Multipack 1: Omega race, Voodoo castle, Cosmic crunch Avenger ● Multipack 2: Gorf, Adventureland, Raid on Fort Knox, Mole Attack. ● Multipack 3: Sargon Chess, The Count, Mission Impossible, Cosmic Cruncher. ● Multipack 4: Sargon Chess, Pirate Cove, Rat Race, Super Lander. ● Multipack 5: Omega Race, The Count, Menagerie, Mole Attack.

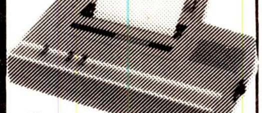
Each Pack Only **£19.98** WHILE STOCKS LAST

SPECIAL OFFER! on Commodore 64 ROM GAMES

SAVE £9.99 when you buy any of the following Multipacks:

MULTIPACK 1: Music Composer, Lazarian & Clowns MULTIPACK 2: Visible Solar System, Jupiter Lander & Le Mans MULTIPACK 3: Visible Solar System, Lazarian & Sea Wolf MULTIPACK 4: Jupiter Lander, Clowns & Lazarian MULTIPACK 5. Jupiter Lander, Omega Race & Clowns

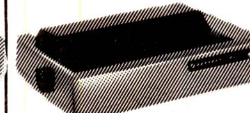
Commodore 1520 PRINTER - PLOTTER



The 1520 printer plotter draws in 4 colours, and prints characters and numbers.

£99.99

COMMODORE 1526 PRINTER



Superb Dot Matrix (near letter quality printer)

£345.00

ACCESSORIES FOR COMMODORE

Alphacom 42 Printer with Vic 20 Interface.... £99.90
Stack Light Pen.... £28.75
Plus 80 16K RAM.... £37.99
Viscount 64K RAM . £69.95
4 Slot Motherboard £24.95
Adman Chatterbox . £49.95
Stonechip 16K switchable RAM............. £34.95

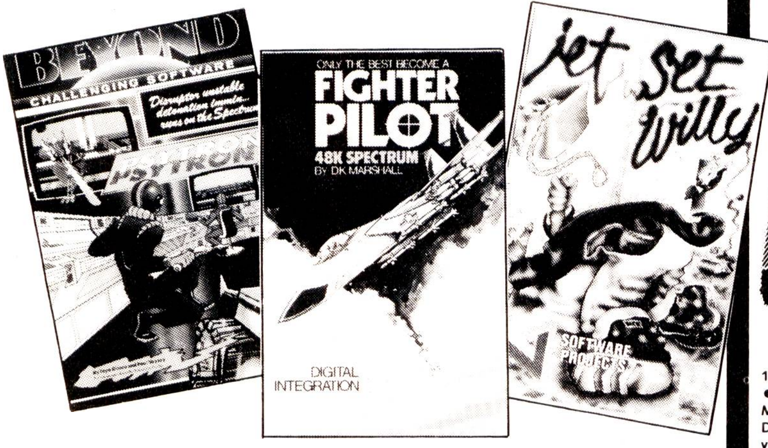
Turn the page for more super offers from Spectrum . . .

Not all stores carry every advertised item, please phone before making a journey - prices correct at time of going to press E&OE

spectrum

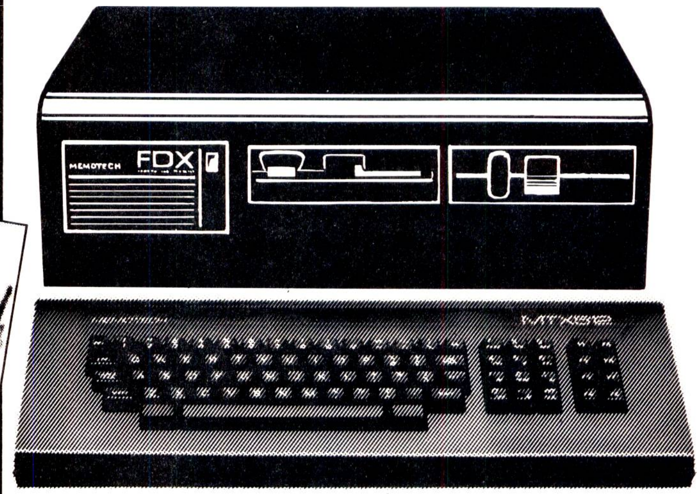
MICRO DEALER UK's TOP 50

Britains No.1 Weekly Software Chart



PROGRAM	SUPPLIER	MACHINE	PRICE
Psytron	Beyond	Spectrum	**£7.95**
Fighter Pilot	Digital	Spectrum	**£7.95**
Night Gunner	Digital	Spectrum	**£6.95**
Jack & the Beanstalk	Thor	Spectrum	**£5.95**
Blade Alley	PSS	Spectrum	**£5.95**
Flight Path 737	Anirog	CBM 64	**£7.95**
Gyropod	Tasket	CBM 64	**£6.90**
Trashman	New Generation	Spectrum	**£5.95**
Solo Flight	MicroProse	CBM 64	**£14.95**
Jet Set Willy	Software Projects	Spectrum	**£5.95**
Flight Path 737	Anirog	VIC 20	**£7.95**
Space Pilot	Anirog	CBM 64	**£7.95**
Code Name Mat	Micromega	Spectrum	**£6.95**
Blagger	Alligata	BBC	**£8.95**
Football Manager	Addictive	Spectrum	**£6.95**
Son of Blagger	Alligata	CBM 64	**£7.95**
Blue Thunder	Richard Wilcox	Spectrum	**£5.95**
Moon Alert	Ocean	Spectrum	**£5.90**
Ad Astra	Gargoyle Games	Spectrum	**£5.95**
Dinky Doo	Software Projects	CBM 64	**£7.95**
Zodiac	Anirog	CBM 64	**£7.95**
Millionaire	Incentive	Spectrum	**£5.50**
Scuba Dive	Durrell/Martech	Spectrum	**£5.90**
Forbidden Forest	Cosmi	CBM 64	**£8.95**
Omega Run 64	CRL	CBM 64	**£7.95**
Fred	Quicksilva	Spectrum	**£6.95**
Krakatoa	Abbex	Spectrum	**£5.95**
Voodoo Castle 64	Adventure International	CBM 64	**£9.95**
Chequered Flag	Psion	Spectrum	**£6.95**
Revenge of Mutant Camels	Llamasoft	CBM 64	**£7.50**
Eagle Empire 64	Alligata	CBM 64	**£7.95**
Hunchback 64	Ocean	CBM 64	**£6.90**
Mugsy	Melbourne House	Spectrum	**£6.95**
Sheep in Space	Llamasoft	CBM 64	**£7.50**
Mr Wimpey BBC	Ocean	BBC	**£6.90**
Wheelie	Microsphere	Spectrum	**£5.95**
Atic Atac	Ultimate	Spectrum	**£5.50**
Football Manager BBC	Addictive	BBC	**£7.50**
Guardian	Alligata	Electron	**£7.95**
Cityattak	K-Tel	CBM 64	**£6.95**
Killerwatt	Alligata	CBM 64	**£7.95**
Aviator	Acornsoft	BBC	**£14.95**
Bozo's Night Out	Tasket	CBM 64	**£6.90**
Chuckie Egg 64	A & F Software	CBM 64	**£7.90**
Pinball Wizard 64	C P Software	CBM 64	**£7.95**
Classic Adventure	Melbourne House	CBM 64	**£6.95**
Bath Time	PSS	CBM 64	**£7.95**
Android II	Vortex	Spectrum	**£5.95**
Odessey	K-Tel	CBM 64	**£6.95**
It's the Wooluf	Crystal	Spectrum	**£6.50**

Superb value-for-money! MEMOTECH MTX SERIES



MEMOTECH MTX 512 64K RAM

16 User definable Function Keys ● 12 Key Numeric Pad ● Z80A at 4MHz ● 24K ROM containing MTX BASIC ● MTX NODDY FRONT PANEL DISPAY ● ASSEMBLER/DISASSEMBLER Video Display Processor with 16K video-RAM ● 64K User RAM Twin RS232 Communications Board ROM Expansions: Node Systems ● MTX PASCAL ● MTX FORTH Eight User Definable Virtual Screens ● Up to 32 SPRITES

SPECTRUM PRICE

£315

Also available MTX 500 32K RAM £275

FDX DISK DRIVE

Up to eight Floppy Drives ● Colour 80 Column Board (optional) Fast Access Silicon Discs ● Powerful Floppy Disc Controller Board CP/M 2.2 Supplied ● Teletext Compatible

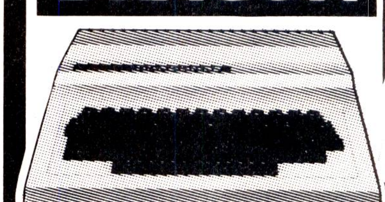
SPECTRUM PRICE **£995.00**

Memotech 32K RAM Expansion £50
Memotech 64K RAM Expansion £85.00
Memotech 128K RAM Expansion £160.00
Memotech RS232 Communication Port £60.00

SEPERATE EXPANSION ITEMS
Silicon Disc (256K) £385.00
80 Column Colour Board £100.00
Floppy Disc Controller Board £230.00
7 Way Bus & Support Software for S.O. £50.00

MEMOTECH SOFTWARE
Backgammon (Cassette) £8.95
Chess (Cassette) £9.95
Blobbo (Cassette) £6.95
Kilopede (Cassette) £6.95
Super Minefield (Cassette) £6.95

DRAGON

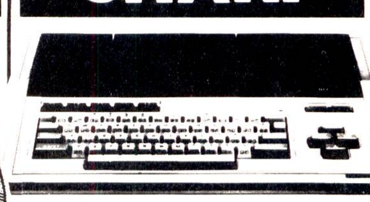


DRAGON 32

Check with your local SPECTRUM dealer for our LOW price

DRAGON 64 **£225.00**

SHARP



SHARP MZ-711

(MZ-700 Series Computer)

The super new colour computer from SHARP. Now available in limited quantities

SPECTRUM PRICE

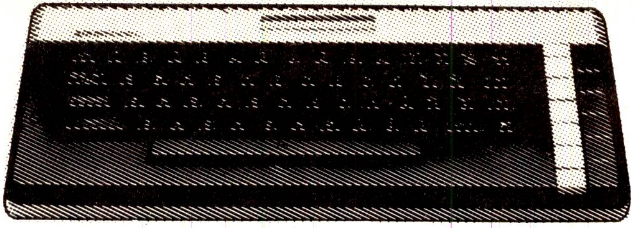
£249.95

with FREE Cassette Recorder and 10 FREE Games

Total Value of Package **over £320.00**

SHARP PRINTER £129.95
CASSETTE RECORDER £39.95

Not all stores carry every advertised item, please phone before making a journey - prices correct at time of going to press E&OE



ATARI 800XL

Powerful 64K RAM ● Full-stroke
yboard ● Full sound with 3½ octave
nge ● 11 Graphic Display modes ● Full
lour (256 Colours - 128 colours can be
splayed at one time) Ask to see this
per new micro at your local SPECTRUM
aler NOW!

SPECTRUM PRICE

£249.95

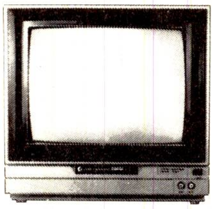
ATARI 600XL.................... £159.99

10 CASSETTE RECORDER £49.99
50 DISK DRIVE £299.99
27 LETTER QUALITY PRINTER £299.99
20 PRINTER PLOTTER £199.99

TRACK BALL.............................. £39.99
SOFTWARE
DIG DUG.................................. £29.99
LONE RAIDER............................ £14.99
And many more

IONITORS

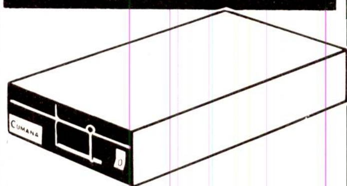
ommodore Model 1701
A superb Colour Monitor with sound



SPECTRUM PRICE **£230**

HOENIX Amber........... **£126.50**
DELITY CM14 Colour........ **£199.95**
ANYO 14" Colour TV (ideal as a
onitor)....................... **£229..95**
ANYO CDD 3125NB Colour
onitor......................... **£285.35**
ANYO 12" Green Monitor...... **£99.95**

CUMANA DISK DRIVES



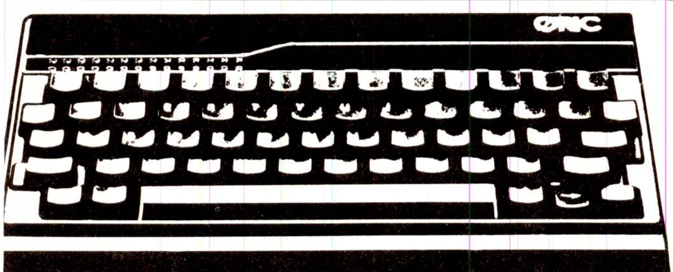
FOR BBC

CS100E................ £217.35
CS100................. £244.95
CS200E................ £254.15
CS200................. £881.75

FOR DRAGON

CDS250 .... £365.95
CDS500 .... £401.80
CDS1000 .... £503.95
CDD500................ £557.60

ORIC ATMOS



The ATMOS has taken a remarkable step
ward in home computer technology!

Most Micros use memory on functions
e graphics, colour and sound. Oric saw
it by running these tasks from ROM
emory, a huge amount of the ATMOS's
luable 48K RAM could be freed.

So the colour capability (8 graphics, 8
ckground), powerful sound synthesis
d high-resolution graphics of the ATMOS
e achieved with fewer demands on com-
ting power than its competitors.

So what else makes the ATMOS so excit-
g? There's now a typewriter-style, full-
sponse keyboard; it's directly compatible
th most domestic cassette players; and
ere's a wide choice of software. The
MOS is designed for convenience, too –
uses extended Microsoft BASIC; your
inter plugs in without an RS232; and it
mes complete with leads and everything
u need to get going.

We've a four-colour ORIC printer (which
cepts normal paper) at a terrific value-
r-money price. Soon, a 3-inch Microdisk
ive will be available, too, to complete
e system. Take a look at the superb new
ric ATMOS, at your Spectrum dealer
ow!

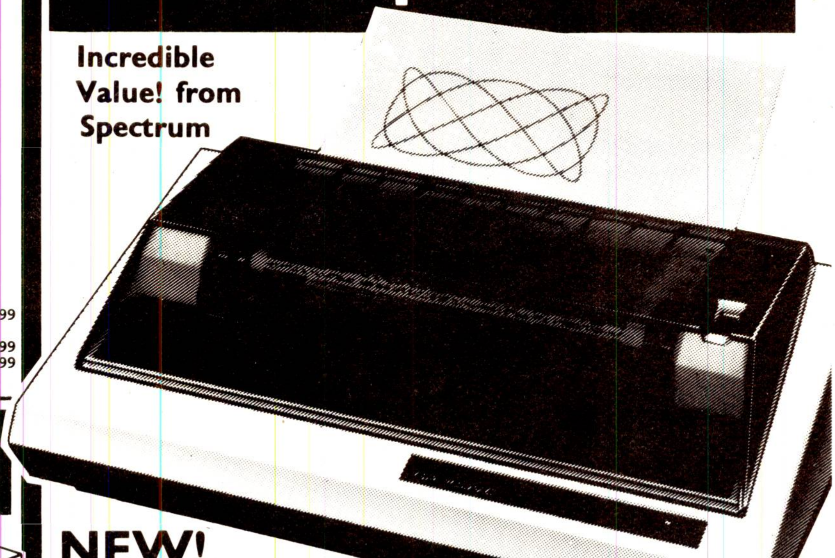
- Lots of exciting programs available
- Built-in centronics printer interface (no RS232 needed - just plug in your printer)
- Full-featured keyboard with sculptured keys
- Seperate keys for cursor control
- Built-in speaker
- Special sound effects for game programmers

SPECTRUM PRICE

£169.99

Sensational PRINTER OFFERS from Spectrum

Incredible Value! from Spectrum



NEW!

SEIKOSHA Model GP100A MkII

- Printing speed 50 C.P.S.
- Full Graphics capability
- Double width character output under software control
- Centronics type parallel interface
- Paper width is adjustable up to 10 inches

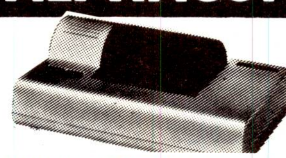
SPECTRUM LOW PRICE

£199.95

Other Printer Bargains

SEIKOSHA GP100 VC **£199.95**
SEIKOSHA GP100 AS............. **£199.95**
SEIKOSHA GP250 X.............. **£249.95**
EPSON FX 80 .... **£495.95**
EPSON RX 80 .... **£314.95**
EPSON RX 80 F/T............... **£366.85**
ALPHACOM 42 for VIC-20, Commodore 64, Dragon, Atari, BBC with required interface........ **£99.90**
ALPHACOM 3C for ZX Spectrum ... **£59.95**
Bit Print 24 for the BBC......... **£89.95**

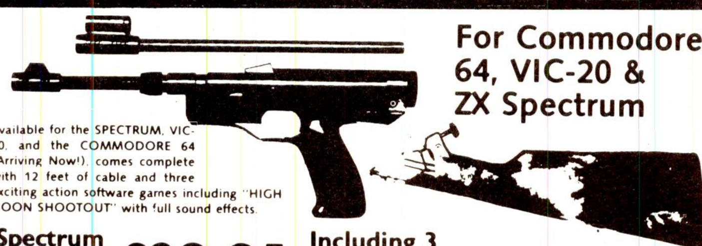
ALPHACOM



ALPHACOM 42 For DRAGON, BBC, COMMODORE, ATARI (Interfaces extra)
.... Spectrum price **£79.95**
ALPHACOM 32 For ZX SPECTRUM
.... Spectrum Price **£59.95**
Paper Rolls for Alphacom printers
Box of 5 Rolls **£6.00**

STACK LIGHT RIFLE

For Commodore 64, VIC-20 & ZX Spectrum



Available for the SPECTRUM, VIC-20, and the COMMODORE 64 (Arriving Now!), comes complete with 12 feet of cable and three exciting action software games including "HIGH NOON SHOOTOUT" with full sound effects.

Spectrum Price **£29.95** Including 3 FREE Games

spectrum CHARGE CARD

UP TO £1,000 Instant Credit

● There's up to £1,000 worth of Instant Credit available on a Spectrum Chargecard. See your local SPECTRUM dealer for written details (UK mainland only) Typical APR -29.8%

Turn the page for more super offers from Spectrum . . .

Spectrum Computer Centres have no connection whatsoever with the ZX-Spectrum Computer manufactured by Sinclair Research Ltd.

spectrum

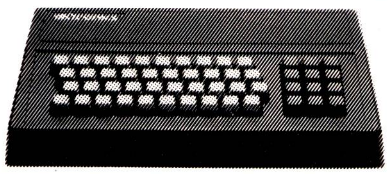
Everything you've ever wanted for your

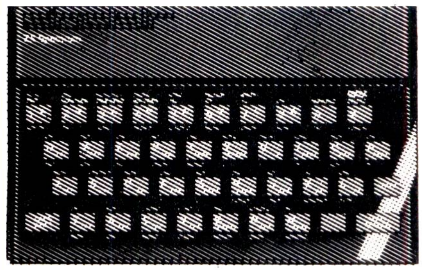
ZX SPECTRUM

Superb ZX add-on's from your local Spectrum dealer

DK'Tronics KEYBOARD

For ZX SPECTRUM
SPECTRUM PRICE
£45





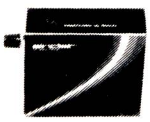
ZX SPECTRUM 16K £99.95
ZX SPECTRUM 48K £129.95
Spectrum Computer Centres have no connection whatsoever with the ZX Spectrum Computer manufactured by Sinclair Research Ltd.

New & exclusive to Spectrum!

INDESCOMP

Superb quality add-on's for the ZX SPECTRUM

SOUND AMPLIFIER



£10.95

32K RAM PACK

£39.95

JOYSTICK Interface

£14.95

DOMESTIC CONTROLLER

£49.95

ALPHACOM Thermal printer for ZX SPECTRUM - NOW DOWN TO **£59.95**

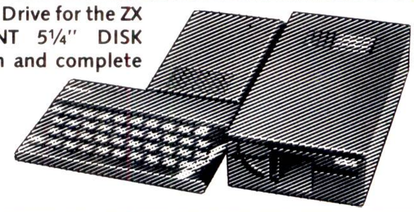
DIGITAL TRACER

From RD Labs for the ZX Spectrum
£55.50

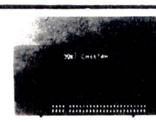
VISCOUNT DISK DRIVE

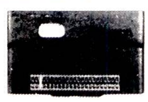
Now from SPECTRUM a Disk Drive for the ZX SPECTRUM. The VISCOUNT 5¼" DISK DRIVE with interface system and complete with all leads.

ONLY
£245



CHEETAH
32K RAM Pack
£39.95



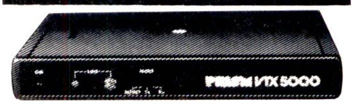


KEMPSTON
Joystick Interface **£15**
(Joysticks opt. extra)

CURRAH Speech Synthesiser . £29.95
DK'TRONICS Lightpen £19.95
DK'TRONICS DUALPORT Joystick Interface £14.95
STACKLIGHT Rifle with 3 FREE GAMES............... £29.95

Sinclair ZX INTERFACE 2
The new ROM Cartridge/Joystick interface. Loads programs instantly! Takes two joysticks! Just plug in and play. **ONLY £19.95**
Plus New ROM cartridge software.

PRISM VTX 5000 MODEM



NOW, YOUR ZX SPECTRUM IS YOUR KEY TO THE WORLD with the incredible PRISM VTX 5000 MODEM

■ Versatile modem for ZX Spectrum (16K or 48K) versions ■ Slim design fits easily, matches your micro ■ Instant access to Prestel™ & Micronet 800 information services ■ Instant communication with other ZX Spectrum users ■ Use the Prism VTX 5000 with a Sinclair printer - and print Prestel frames

SPECTRUM PRICE
£99.95

STONECHIP ACCESSORIES

For the ZX SPECTRUM
ECHO AMPLIFIER
£19.95
PROGRAMMABLE JOYSTICK INTERFACE **£24.95**

Coming soon ....
SPECTRUM KEYBOARD WITH SOUND NO NEED TO TAKE YOUR SPECTRUM APART
£59.95

BOOKS

GRANADA PERSONAL COMPUTING TITLES
The ZX Spectrum and how to get the most from it **£5.95**
The Spectrum Programmer **£5.95**
The Spectrum Book of Games **£5.95**
Introducing Spectrum Machine Code **£7.95**
The Apple II Programmer's Handbook **£10.95**
Programming with Graphics **£5.95**
The Dragon & how to make the most of it . **£5.95**
Computing for the Hobbyist & small Business **£6.95**
Simple Interfacing Projects **£6.95**
The BBC Micro: An expert guide **£6.95**
Commodore 64 Computing **£5.95**
The Oric-1 and how to get the most from it **£5.95**
The Dragon 32 book of games **£5.95**
Computer Languages and their uses **£5.95**
Lynx Computing **£6.95**
21 Games for the BBC Micro **£5.95**
Choosing a Microcomputer **£4.95**
Databases for fun & profit **£5.95**
Introducing the BBC Micro **£5.95**

SUNSHINE
The Working Spectrum **£5.95**
Functional Forth for the BBC **£5.95**
The Working Dragon 32 .... **£5.95**
Dragon 32 Games Master **£5.95**
The Working Commodore 64 .... **£5.95**
Commodore 64 Machine Code Master **£6.95**
The Working Dragon **£5.95**
The Working Spectrum **£5.95**
The Working CBM 64 .... **£5.95**
Dragon 32 Games Master **£5.95**

JOHN WILEY
Atari Basic **£9.75**
Using BBC Basic **£6.95**
Winning games on the Commodore 64 . . **£5.95**
Hot programs to feed your Dragon **£6.95**
ZX Spectrum explored **£5.95**
Mastering th ZX Spectrum **£5.95**
Mastering the Vic 20 .... **£5.95**
Small business computers for the first time users **£7.95**

Spectrum Computer Centres have no connection whatsoever with the ZX-Spectrum Computer manufactured by Sinclair Research Ltd.

There's a Spectrum Centre near you . .

AVON

BATH Software Plus, 12 York St Tel: (0225) 61676
WESTON-S-MARE K & K Computers, 32 Alfred St Tel: (0934)419324

BEDFORDSHIRE

DUNSTABLE Dormans 7-11 Broad Walk Tel: (0582) 65515
LEIGHTON BUZZARD The Computer Ctr at Milton Keynes Music, 17 Bridge St. Tel: (0525)376622
LUTON Terry-More, 49 George St. Tel: (0582) 23391/2

BERKSHIRE

BRACKNELL Computer Centre, 44 The Broadway. Tel: (0344) 427317
SLOUGH MU Games and Computers 245 High St. Tel: (0753) 21594

BUCKINGHAMSHIRE

BLETCHLEY Rams Computer Centre, 117 Queensway. Tel: (0908) 647744
CHESHAM Reed Photography & Computers, 113 High St. Tel: (0494) 783373

CAMBRIDGESHIRE

CAMBRIDGE K P Computers Ltd. 19/20 Market St. Tel: (0223) 312240 (Open 6 Days)
PETERBOROUGH Ptrbrgh Communications, 91 Midland Rd. (0733) 41007

CHANNEL ISLANDS

GUERNSEY Gruts, 3-5 The Pollett, St Peter Port. Tel: (0481) 24682
JERSEY Audio & Computer Centre, 7 Peter St, St Helier. Tel: (0534) 74000

CHESHIRE

ALTRINCHAM Mr Micro 28 High St. Tel: (061) 941 6213
CREWE Microman Unit 2, 128 Nantwich Rd. Tel: (0270) 216014
ELLESMERE PORT RFR Computers, 1 Pooltown Rd. Whitby. Tel: 051 356 4150
MACCLESFIELD Camera & Computer Centre 118 Mill St. Tel: (0625) 27468
STOCKPORT Wilding Ltd. 1 Little Underbank Tel: (061) 480 3435
WARRINGTON Wildings, 111 Bridge St. Tel: (0925) 38290
WIDNES Computer City, 78 Victoria Road. Tel: (051) 420 3333
WILMSLOW Swift of Wilmslow, 4-6 St. Annes Parade. Tel: (0625) 526213

CLEVELAND

MIDDLESBOROUGH McKenna & Brown, 206 Linthorpe Rd. Tel: (0642) 222368

CORNWALL

ST AUSTELL A B & C Computers, Duchy House, 6 Lower Aylmer Sq. Tel: (0726) 67337

CUMBRIA

BARROW-IN-FURNESS Barrow Computer Centre. 2/4 The Mall. Tel: (0229) 38353
CARLISLE The Computer Shop, 56-58 Lowther St. Tel: (0228) 27710
PENRITH Penrith Communications, 14 Castlegate. Tel: (0768) 67146 Open Mon-Fri till 8pm
WHITEHAVEN P D Hendren 15 King St. Tel: (0946) 2063

DERBYSHIRE

ALFRETON Gordon Harwood 69-71 High St. Tel: (0773) 832078
CHESTERFIELD The Computer Centre, 14 Stephenson Place Tel: (0246) 208802
DERBY C T Electronics, at Camera Thorpe, The Spot Tel: (0332) 360456

DEVON

EXETER Seven Counties (Computers) Ltd., 7 Paris Street. Tel: (0392) 211212
EXMOUTH Open Channel, 30 The Strand. Tel: (0395) 264408
PLYMOUTH Syntax Ltd., 76 Cornwall St. Tel: (0752) 28705
TIVERTON Actron Micro Computers, 37 Bampton St. Tel: (0884) 252854
TORQUAY Devon Computers, 8 Torhill Rd., Castle Circus. Tel: (0803) 526303

DORSET

BOURNEMOUTH Lansdowne Computer Ctr 1 Lansdowne Crescent. Tel: (0202) 20165

DURHAM

DARLINGTON McKenna & Brown, 102 Bondgate. Tel: (0325) 459744

ESSEX

BASILDON Godfrey's 28-32 East Walk, Tel: (0268) 289379
BASILDON Godfrey's Computer Centre, 5 Laindon Main Centre Laindon. Tel: (0268) 416747
CANVEY ISLAND Tower Radio Ltd., 43 High St. Tel: 0268 682211
CHELMSFORD Maxton Hayman Ltd., 5 Broomfield Rd. Tel: (0245) 354595
COLCHESTER Colchester Computer Ctr. 16 St. Botolphs St. Tel: (0206) 47242
GRAYS H Reynolds. 79 Orsett Rd. Tel: (0375) 5948
ILFORD Woolfmans, 76 Ilford Lane. Tel: (01) 478 1307
ROMFORD Computer Centre, 72 North St. Tel: 0708 752862
SOUTHEND Computer Centre 332 London Rd. Tel: (0702) 45412

HAMPSHIRE

BASINGSTOKE Fisher's, 2-3 Market Place. Tel: (0256) 22079
PORTSMOUTH (Waterlooville) G B Microland, London Rd., (Opp. Co-op) Tel: (07014) 59911
SOUTHAMPTON RJ Parker & Son Ltd., 11 West End Rd., Bitterne. Tel: (0703) 445926
SOUTHAMPTON L.T.C. Ltd., 112 East St., Tel: (0703) 333958/24703
WINCHESTER Winchester Camera & Computer Centre. 75 Parchment St. Tel: (0962) 53982

HEREFORD

HEREFORD Melgray Hi-Tech Ltd., 49 Broad St. Tel: (0432) 275737

HERTFORDSHIRE

BOREHAMWOOD Master Micro, 36 Shenley Rd. Tel: (01) 953 6368
HITCHIN Camera Arts (Micro Computer Division), 68A Hermitage Rd., Tel: (0462) 59285
POTTERS BAR The Computer Shop, 197 High St. Tel: (0707) 44417
ST ALBANS (Herts) Clarks Computer Centre 14-16 Hollywell Hill. Tel: (0727) 52991
STEVENAGE D J Computers, 11 Town Square. Tel: (0438) 65501
WATFORD SRS Microsystems Ltd., 94 The Parade, High St. Tel: (0923) 26602
WELWYN GARDEN CITY D J Computers, 40 Fretherne Rd., Tel (07073) 28435/28444

HUMBERSIDE

BEVERLEY Computing World, 10 Swaby's Yard Dyer Lane. Tel: (0482 881831
GRIMSBY RC Johnson Ltd., 22 Friargate, Riverhead Centre. Tel: (0472) 42031
HULL The Computer Centre, 26 Anlaby Rd. Tel: (0482) 26297

ISLE OF MAN

DOUGLAS T H Colebourn Ltd., 57-61 Victoria St. Tel: (0624) 3482

ISLE OF WIGHT

COWES Beken & Son. 15 Bath Rd. Tel: (0983) 297181

KENT

BECKENHAM Supa Computers Ltd., 425 Croydon Rd., Tel: (01) 650 3569
BROADSTAIRS Video Vision 19/20 Willow Court, St. Peters Park Road Tel: (0843) 63284 (No Early Closing Day)
BROMLEY Computers Today 31 Market Square Tel: (01) 290 5652
DOVER Kent Photos & Computers, 4 King St. Tel: (0304) 202020
GRAVESEND Marshalls Computers & Cameras, 3 Windmill St. Tel: (0474) 65930
RAINHAM Microway Computers Ltd., 39 High St. Medway Towns. Tel: (0634) 376702
SEVENOAKS Ernest Fielder Computers, Dorset St. Tel: (0732) 456800
SITTINGBOURNE Computers Plus, 65 High St. Tel: (0795) 25677
TUNBRIDGE WELLS Modata Cmptrs Ltd. 28-30 St Johns Rd. Tel: (0892) 41555

LANCASHIRE

ACCRINGTON PV Computers, 104 Abbey St. Tel: (0254) 36521/32611
BLACKBURN Tempo Computers, 9 Railway Rd. Tel: (0254) 691333
BURNLEY IMO Computer Centre, 39/43 Standish St BB11 1AP Tel: (0282) 54299
BURY (Lancs) Micro-North, 7 Broad St. Tel: (061) 797 5764
PRESTON Wilding's, 49 Fishergate. Tel: (0772) 556250

LEICESTERSHIRE

MARKET HARBOROUGH Harborough Home Computers, 7 Church St. Tel: (0858) 63056

LINCOLNSHIRE

LINCOLN MKD Computers, 24 Newlands, Tel: (0522) 25907

LONDON

E6 Percivals, 85 High St. North, East Ham. Tel: (01) 472 8941
E17 Erol Computers Ltd., 125 High Street Walthamstow Tel: (01) 520 7763
EC1 Pedro Computer Services Ltd., 47 Clerkenwell Road Tel: (01) 251 8635
EC2 Devron Computer Centre, 155 Moorgate Tel: (01) 638 3339/1830
N14 Logic Sales, 19 Broadway, The Bourne, Southgate. Tel: (01) 882 4942
N20 Castlehurst Ltd. 1291 High Rd. Tel: (01) 446 2280
NW4 Da Vinci Computer Store, 112 Brent St., Hendon Tel: (01) 202 2272
SE1 Vic Odden's 6 London Bridge Walk. Tel: (01) 403 1988
SE9 Square-Deal, 373-375 Footscray Rd., New Eltham. Tel: (01) 859 1516
SE15 Castlehurst Ltd., 152 Rye Lane, Peckham. Tel: (01) 639 2205
SW5 CLM/Matmos 264 Earls Court Tel: (01) 373 458/6333
SW16 Buffer Micro Shop, 310 Streatham High Rd. Tel: (01) 769 2887
SW19 Emcom, 31 High St., Wimbledon. Tel: (01) 947 7678
W1 Computers of Wigmore St., 87 Wigmore St. Tel: (01) 486 0373
W1 GK Photo & Computers, 92-94 Wardour St. Tel: (01) 437 0182
W1 Sonic Foto & Micro Centre, 256 Tottenham Court Rd. Tel: (01) 580 5826
W2 Devron, 4 Edgware Rd. Tel: (01) 724 2373
W7 TK Electronics, 11/13 Boston Rd., Hanwell. Tel: (01) 579 2842

MANCHESTER GREATER

BOLTON Wilding Ltd., 23 Deansgate. Tel: (0204) 33512
MANCHESTER Lomax Ltd., 8 Exchange St. St. Ann's Square. Tel: (061) 832 6167
OLDHAM Home & Business Computers Ltd., 54 Yorkshire St. Tel: (061) 6331608
ROCHDALE Home & Business Computers, 75 Yorkshire St. Tel: (0706) 344654
SWINTON Mr Micro Ltd., 69 Partington Lane. Tel: (061) 728 2282 Late Night Friday
WIGAN Wilding Ltd., 11 Mesnes St. Tel: (0942) 44382

MERSEYSIDE

BIRKENHEAD Fairs Cameras & Hi-Fi, Dacre Hill, Rock Ferry. Tel: (051) 645 5000
HESWALL Thornguard Computer Systems, 46 Pensby Rd. Tel: (051) 342 7516
HUYTON Ian Houghton 5 Huyton Hey Rd. Tel: (051) 489 5785
LIVERPOOL Beaver Radio, 20-22 Whitechapel. Tel: (051) 709 9898
LIVERPOOL (Aintree) Hargreaves, 31-37 Warbreck Moor. Tel: (051) 525 1782
SOUTHPORT Central Computers, 575 Lord St. Tel: (0704) 31881
ST HELENS Studio 55, 55 Ormskirk St. Tel: (0744) 39496

MIDDLESEX

EDGWARE GK Photographic & Computers 106 High St. Tel: (01) 951 1000
HARROW Camera Arts, (Micro Computer Division) 42 St Ann's Rd. Tel: (01) 427 5469
STAINES Spelthorne Microsystems Ltd. 2 Kingston Rd. Tel: (0784) 55659/55554
TEDDINGTON Andrews, Broad St. Tel: (01) 977 4716
UXBRIDGE J K L Computers, 7 Windsor St. Tel: (0895) 51815

NORFOLK

FAKENHAM Fastview, 12 Norwich Rd. Tel: (0328) 51319
NORWICH Sound Marketing, 52 St. Benedicts St. Tel: (0603) 667725
THETFORD C B & Micros, 21 Guidhall St. Tel: (0842) 61645

NORTHAMPTONSHIRE

NORTHAMPTON Dormans, 22 Princes Walk Grosvenor Centre. Tel: (0604) 37031

NOTTINGHAMSHIRE

NOTTINGHAM Jacobs Computers, 13 Middlegate Newark. Tel: (0636) 72594
WORKSOP Computagrafix, 132 Bridge St. Tel: (0909) 472248

NORTHERN IRELAND

BELFAST Arthur Hobson Ltd., 37 Great Victoria St. Tel: (0232) 246336
PORTSDOWN Pedlows, 16 Market St., Craigavon Co Armagh. Tel: (0762) 332265
LONDONDERRY Foyle Computer Systems, 3 Bishop St. Tel: (0504) 268337
NEWRY Newry Computer Centre. 34 Monaghan St. Tel: (0693) 66545

NORTHUMBERLAND

MORPETH Telerents 31 Newgate St. Tel: (0665) 513 537

OXFORDSHIRE

ABINGDON Ivor Fields Computers, 21 Stert St. Tel: (0235) 21207
BANBURY Computer Plus, 2 Church Lane. Tel: (0295) 55890
OXFORD Ivor Fields, 7 St Ebbes St. Tel: (0865) 247082

SCOTLAND

ABERDEEN North East Computers, 1-3 Ellis St., Peterhead. Tel: (0779) 79900
AYR Vennals, 6A New Bridge St. Tel: (0292) 264124
DUMFRIES Vennals, 71 English St. Tel: (0387) 54547
EDINBURGH The Silicon Centre, 6-7 Antigua St. Tel: (031) 557 4546
GLASGOW Victor Morris Ltd., 340 Argyle St. Tel: (041) 221 8958
HAMILTON Tom Dickson Computers, 8-12 Cadzow St. Tel: (0698) 283193
KILMARNOCK Vennals, 49 Foregate. Tel: (0563) 32175
STORNOWAY Cameron's Computers The Playhouse. Tel: (0851) 3427

SHROPSHIRE

SHREWSBURY Computerama, 13 Castlegate. Tel: (0743) 60528
TELFORD Computer Village, 4 Hazeldine House Telford Town Centre. Tel: (0952) 506771

SOMERSET

TAUNTON Grays, 1 St James St. Tel: (0823) 72986

STAFFORDSHIRE

STAFFORD Computerama, 59 Forgate St. Tel: (0785) 41899
STOKE-ON-TRENT Computerama, 11 Mkt Square Arcade Hanley. (0782) 268620
STOKE-ON-TRENT The Microchip, 37 Station Rd. Biddulph Tel: (0782) 511559

SUFFOLK

BURY ST EDMUNDS Bury Computer Centre, 11 Guildhall St. Tel: (0284) 705772
IPSWICH Brainwave, 24 Crown St. Tel: (0473) 50965
LOWESTOFT John Wells, 44 London Rd North Tel: (0502 3742

SURREY

CAMBERLEY Camera Arts (Micro Computer Division), 36 High St. Tel: (0276) 65848
CHERTSEY Chertsey Computer Centre, 1 Windsor St. Tel: (09328) 64663
EPSOM The Micro Workshop, 12 Station Approach Tel: (03727) 21533
HASLEMERE Haslemere Computers, 25 Junction Pl. (Adj. Rex Cinema) Tel: (0428) 54428
NEW MALDEN Surrey Micro Systems, 31 High St. Tel: (01) 942 0478
RICHMOND Crest Computer Services, 8 Hill St. Tel: (01) 940 8635
WALLINGTON Surrey Micro Systems Ltd., 53 Woodcote Rd. Tel: (01) 647 5636
WOKING Harpers, 71-73 Commercial Way. Tel: (04862) 61061

SUSSEX

BEXHILL-ON-SEA Computerware, 22 St Leonards Rd. Tel: (0424) 223340
CRAWLEY Gatwick Computer Services, 62 Boulevard. Tel: (0293) 37842
LITTLEHAMPTON Alan Chase Ltd., 39 High St. Tel: (09064) 5674

WALES

ABERDARE Inkey Computer Services Ltd., 70 Mill St. The Square Trecynon. Tel: (0685) 881828
ABERYSTWYTH AberData at Galloways, 23 Pier St. Tel: (0970) 615522
CARDIFF Randall Cox, 18-22 High St Arcade. Tel: (0222) 31960
LLANDUDNO (Gwynedd) Computer Plus Discount, 15 Clomnel St. Tel: (0492) 79943
NEWPORT (Gwent) Randall Cox, 118 Commercial St. Tel: (0633) 67378
PEMBROKE Randall Cox, 19 Main St. Tel: (064) 682876
WREXHAM T E Roberts, 26 King St. Tel: (0978) 364404/364527

WARWICKSHIRE

NUNEATON Micro City 1A Queens Road Tel: (0203) 382049
RUGBY The Rugby Micro Centre, 9-11 Regent St. Tel: (0788) 70522

WEST MIDLANDS

BIRMINGHAM Sherwoods, Gt Western Arcade. Tel: (021) 236 7211
COVENTRY Greens, 22 Market Way. Tel: (0203) 28342
DUDLEY Central Computers, 35 Church Hill Precinct. Tel: (0384) 238169
WEST BROMWICH Bell & Jones, 39 Queens Square. Tel: (021) 553 0820

WILTSHIRE

SALISBURY Whymark Computer Centre, 20 Milford St. Tel: (0722) 26688

WORCESTER

KIDDERMINSTER Central Computers, 20-21 Blackwell St. Tel: (0562) 746941
WORCESTER David Waring Ltd., 1 Marmion House High St. Tel: (0905) 27551

YORKSHIRE

BRADFORD Erricks, Fotosonic House Rawson Square. Tel: (0274) 309266
DEWSBURY Home & Business Computers, 59 Daisy Hill. Tel: (0924) 455300
DONCASTER The Soft Centre 8 Queensgate Waterdale Centre Tel: (0302) 20088
HUDDERSFIELD Richards (Formerly Lauries) 12 Queen St. Tel: (0484) 25334
HULL Computer Centre 26 Anlaby Rd. Tel: (0482) 26297
LEEDS Bass & Bligh, 4 Lower Briggate. Tel: (0532) 454451
YORK York Computer Centre 7 Stonegate Arcade. Tel: (0904) 641862

Not all stores carry every advertised item, please phone before making a journey - prices correct at time of going to press E&OE

Ambassador Service

Starp

Star Europe GmbH. Frankfurter Allee 1-3.

stx-80.

The Silent.

Prints 60 characters per second with muffled serenity. Standard ASCII, selectable international characters. Block graphics and bit-image-graphics. The stx-80. At a price to start with. Soft on the ear. Easy on the purse.

gemini-10X.

The Bestseller.

No.1 in the range, the gemini-10X has swiftly soared to stardom. 120 characters fast per second. Economical. Reliable. And now compatible with IBM: gemini-10i. Any more details? Let us know. We support you.

gemini-15X.

The Economical.

At Pro-Range.

For professional output at a reasonable price the gemini-15X is hard to beat. The print-head provides you with more than 100 million characters. gemini-15X. The optimal price/output relation.

delta-10.

The Powerful.

Serial and parallel interface. 8k-byte buffer. Macroinstruction. 2 x 96 download characters. Bi-directional printing with logical seeking. Where others speak of extras we mean standard. The delta-10.

Discount Micros!

SAVE HUNDREDS OF £££s

on the BEST RANGE OF MICROCOMPUTERS at the BEST PRICES!

IBM PC – Full system

64K System Unit
2 x 320K Drives
Keyboard
High Res. Monitor

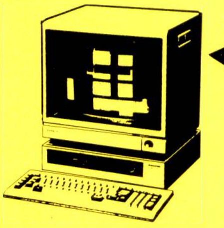
~~£2500~~ **£1798***

Sirius 1 – Full system

128K System Unit
2 x 600K Drives
Keyboard
High Res. Monitor

~~£2200~~ **£1698***

SANYO MBC 550

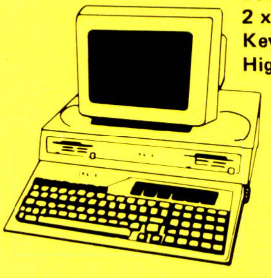


NEW

128K System Unit
1 x 160K Drive
Keyboard
Spread Sheet
Wordstar

~~£800~~ **£698***

apricot – Full system



256K System Unit
2 x 315K Drives
Keyboard
High Res. Monitor

~~£1900~~ **£1398***

including a range of software FREE

COMPAQ™

(Fully IBM compatible portable computer)

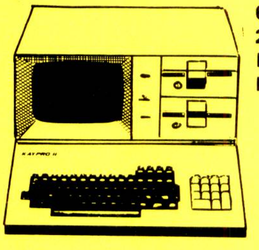
– Full System

256K System Unit
2 x 320K Drives
Colour interface
Keyboard
High Res. Monitor

~~£2200~~ **£1898***

KAYPRO II – Full system

(Portable Computer)



64K System Unit
2 x 200K Drives
Keyboard
High Res. Monitor

~~£1700~~ **£998***

including over £1000 worth of software FREE

APRICOT	
256K 10MB + Mon	£2388
256K 5MB + Mon	£2148
256K, 2 x 720K + Mon	**£1698**
256K, 2 x 315K + Mon.	£1398

COMPAQ	
256K, 10MB	£3398
256K, 2 x 320K	£1898

KAYPRO	
Kaypro 10	£2095
Kaypro IV	£1395
Kaypro II	£998

IBM PC	
128K 'XT' 10MB	£3698
128K 'XT' 10MB Colour	£3898
64K 'PC' 2 x 320K	£1798
64K 'PC' 2 x 320K Colour	£1998

SANYO	
MBC 550 (128K, 1 x 160K)	£698
MBC 555 (128K, 2 x 160K)	£898
Mono Monitor (High Res.)	£116
Colour Monitor (High Res.)	£398

SIRIUS	
256K, 10 MB	£2998
256K, 2 x 1.2MB	£2198
128K 2 x 600 K	£1698

SPECIAL!

OLIVETTI M20 ~~£2,500~~ **£1,699***

Other machines on request.
Plus a whole range of software & peripherals.

To place your order for IMMEDIATE DELIVERY, call Vanessa James on 01-938 1721 (20 lines)

*Offer lasts for limited period only and is subject to VAT and change without notice!

Discount Micros Ltd.
7 Kensington High Street, London W.8.

Please send me

☐ Quote on ________ ☐ Information on ________ ☐ Ring me ☐ Urgent

Name ________ Title ________
Company ________
Address ________
____
________ Postcode ________
Phone ________ Extension ________

WM7/84

WINNERS OF
The Business Software Award.
JOINT WINNERS OF
The Software of the Year Award
in the British Microcomputing Awards 1984.

PRESS THE BUTTON...

Don't waste your time... waiting for printouts!

AND THE ECONO-BUFFER RUNS

THE PRINTER-BUFFER WITH ALL THESE EXTRA'S ...AND THE BEST AND CHEAPEST YOU CAN BUY.

NO EXTRA SOFTWARE NEEDED...

COMPATIBLE WITH ANY STANDARD CENTRONICS PRINTER

Options select by a simple press.
Superb quality.
Attractive compact design.
Professional documentation.

SPACE COMPRESSION

SINGLE PAGE MODE for stops between printouts or pages

PAGE NUMBERING MODE buttons for various page lengths

COPY-FUNCTION

Contact your local dealer or ZERO for details

48K **£ 119**

also 16K (£ **102**) and 32K (£ **111**) versions available.

Printer buffer also for RS 232-Centronics

16K	32K	48K
£ 94	£109	£ 123

zero ELECTRONICS

149 KINGSTREET (NASH HOUSE)
GT. YARMOUTH NR30 2-S
TELEPHONE: (0493)-2023

- All prices exclude VAT
- Supplier to schools, universities and government departments
- All products guaranteed
- Send for free details + order form
- Money refunded (less P.&P.), if goods returned in good condition within 10 days

0100

ZERO Companies: The Netherlands: Tel. 01892 - 5333 - Germany: Tel. 02821 - 28826 Sweden: Tel. 0382 - 40037

SALE SALE SALE

I.B.M.

GOLFBALL PRINTERS

SALE PRICE £39.99 + VAT
INTERFACE EXTRA

5" Monitor (New).................... **£40.00 + VAT**
Keyboards....................... **from £4.00 + VAT**
Mini Cassette Drives............... **£20.00 + VAT**
Centronics Printers (New) **from £150.00 + VAT**

PCB's, FANS, POWER UNITS, ETC.

COME AND LOOK AROUND

P & R COMPUTER SHOP

**Salcote Mill, Goldhanger Road,
Heybridge, Maldon,
Essex.**

PHONE: (0621) 57440

HOURS: MON-FRI 9am-5pm SAT 9am-12am

SEESCAN DEVICES

COMPUTER VISION SYSTEMS

IF YOU NEED TO: Count bacterial growth; process animal behaviour; examine X-ray/photographic plates; measure leaf area; study fractures in metals or could use a **low cost, well engineered, reliable image processing package,** then the **Seescan Digital Camera and Framestore for the BBC Micro at £465 inc VAT** is a must for you!

Menu driven software covers various applications and fully documented programs show how to combine our subroutines easily in your own programs!

Unit includes: monochrome camera, Z80A second processor, 16K framestore, 2K RAM, 4K monitor ROM, 1 MHz bus interface, BBC software, comprehensive operators manual and listings of supplied software including Z80 monitor, BBC assembly subroutines and BASIC programs.

ALSO

We offer a range of

HIGH RESOLUTION FRAMESTORES

**in monochrome or colour from:
256 × 256 × 16 shades
to 800 × 800 × 128 shades**

DESIGN AND CONSULTANCY SERVICES

By experienced design team, rapid personal service. We guarantee to be competitive — let us quote for your specific need.

**Ring Seescan on 0223 314553/61376
or write to
Seescan Devices, 25 Gwydir Street,
Cambridge CB1 2LG**

SEESCAN DEVICES

CONVERT YOUR 80-BUS SYSTEM TO 16 BIT WITH A COSTGOLD ADD-ON PROCESSOR BOARD

Run CP/M-86. Read/write IBM PC compatible discs.

CA802 **£525**
- 8MHz 8088 Processor
- 256K Bytes RAM
- Serial port and real time clock
- EPROM based monitor
- Supports CP/M-86, concurrent CP/M-86 and MP/M-86

CA801 **£375**
- 8MHz 8088 Processor
- 128K Bytes RAM
- EPROM based monitor
- Supports CP/M-86
- Can be expanded later to CA802 spec

CP/M-86 for CA801/CA802, including utilities **£199**

SPECIAL OFFER . . . CA802 and CP/M-86 **£695**

Either 80-bus format board enables retention of the Z80 card to run your existing software. Both cards will read or write IBM PC compatible discs and all Gemini formats. A 8088 bus expansion connector is also provided.

All prices include p&p but exclude VAT at 15%.

CA801 & CA802 are available now. Orders to Costgold Research, The Old School, Stretham, Cambridge CB6 3LD. Tel: (035 389) 282/3.
Coming soon, Concurrent CP/M-86

COSTGOLD RESEARCH, THE OLD SCHOOL, STRETHAM, CAMBRIDGE

Macintosh

in the

Midlands

Apple's newly released personal computer system

'phone (0203) 23000
for details of

- Competitive price
- Personal demonstration
- Full support service
- Personal delivery and training service throughout the UK

Adelphi Business Computers Ltd
25 Trinity Street
Coventry CV1 1FJ
Tel: 0203 23000

Also Lisa 2, Apple IIc, Apple III, Apple IIe

Lisa

apple authorised dealer

LOOKING FOR SOFTWARE?

WE HAVE BUILT A LIBRARY OF INFORMATION ON WHAT IS AVAILABLE

A PHONE CALL IS ALL IT WILL COST YOU TO GET SOMEONE ELSE TO COME UP WITH THE ANSWER

01-625 5404

Walters COMPUTERS

LOOK

GAMES PROGRAMMERS

You could be earning

£20,000

for your games whatever the machine

SEND YOUR GAMES IN NOW!

Send tape and instructions to:
Ian Smart, Software Development Manager,

Walters Computer Systems Limited,
12 Hagley Road,
Stourbridge,
West Midlands DY8 1PS.

MICROCOMPUTER DEALERS FOR: PEACHTREE

EPSON NEC SANYO

PX-8 NOW IN STOCK

EPSON — Computers and Printers
QX-10 Desktop + RX-80 + CP/M + Word Processing + Spreadsheet and Mailing List Manager £1999
HX-20 Portable 16K BASIC Computer £411
PX-8 New Exciting Portable CP/M System .... **PHONE**
TF-20 Dual 340K Disks for HX/PX £499
CX-21 Acoustic Coupler 300 Bd Re-chargeable £160
Bar Code Reader for HX/PX £82
LQ1500 200 cps/65 cps letter quality printer **£1100**
FX-80/RX-80/JX-80/HI-80 Printers .... PHONE
DX-100 13 cps Daisy Wheel Printer £475

PX-8 Portable CP/M Computer including Wordstar, Spreadsheet, Cardbox and Basic £798
RAM Disk for PX-8 — 129K Data Memory. Special Price if ordered with PX-8 .... £200

SANYO — Lowest Priced 16 Bit MS-DOS, 128 Kb Memory
MBC550 Single Disk, Wordstar, Calcstar £749
MBC555 Dual Disk, Wordstar, Calcstar, Infostar, Reportstar £999

NEC — 16 Bit PC with 1M Byte Diskettes
APC Monochrome Single Disk £1735
APC Monochrome Dual Disk £1985
APC Colour Dual Disk £2595
8201A Portable Computer £475

CANON — Fantastic Compact Portable
X-07 Portable 8K BASIC Computer £208

BROTHER
EP-44 Portable Terminal Printer £220

COMMUNICATIONS
Buzzbox 300 Bd Modem (Inc PSU) £81
UK 250 10 Memory Telephone £35
BT Hawk Cordless Telephone £147

SOFTWARE
Barcode Reading ROM for HX-20 .... £50
Barcode Printing Concept Software HX20/QX10/PC £95

A wide range of Business, Bar Code, Graphic, Data Capture and Communications Software is available for the above systems.
Telephone for details.

SERVICE AND MAINTENANCE
We specialise in the repair of EPSON products. For a modest annual fee you can have all the benefits of ACTEL's extended warranty including Securicor both ways for depot repairs and the use of our telephone HELP line. Same day replacement and on site service also available. Write or phone for details.

All prices exclude Value Added Tax and Carriage and are subject to revision in accordance with Manufacturers lists. Carriage free on all pre-paid orders.

ACTEL

GENERAL, ACCOUNTS, W.P., ELECTRONIC ORDER ENTRY, GRAPHICS, BAR CODES, COMMUNICATIONS.

Actel Computers Limited
The Computer Centre, Bugbrooke Road, GAYTON, NORTHAMPTON NN7 3EU. TEL: (0604) 858011

Memotech MT
NewWord® to Ne

MTX NEWWORD + MTX512
A UNIQUE COMBINATION

MTX NewWord, running on the Memotech MTX512, sets an entirely new set of performance standards for microcomputer based word processors. MTX NewWord has been specially adapted from its CP/M version to run on the MTX512 without discs. The program still uses CP/M, and has all the facilities of CP/M – the only difference between MTX NewWord and a disc based package is that MTX NewWord is faster and much more cost-effective.

DEVELOPED ON DISC TO RUN ON ROM

The power of MTX NewWord is in its software – it doesn't need expensive disc drives and their supporting hardware even though it operates as if it had them.

It is this feature that makes the progam unique – it has disc sized power without a disc sized price.

MTX NewWord was developed by the same team that created Wordstar – the powerful word processing system designed for the business environment.

THE PROGRAM

Memotech have combined the professional typewriter style keyboard of the MTX Series with ROM memory, to produce a package that has everything a disc based system has.

The program is Menu-driven, which means it includes a step by step Onscreen Guide to all its functions, with Opening, Editing, Saving & Printing, Quick Function, On-Screen Format and Help menus plus many fast, powerful functions like FIND, SEARCH & REPLACE and DECIMAL TABBING.

If you've ever used Wordstar, you're already familiar with MTX NewWord – NewWord's increased speed and efficiency are the only noticeable differences.

THE MTX NEWWORD PACKAGE

MTX NewWord on disc sells for $249.00 in the USA, although MTX NewWord on ROM costs only £75.00 (or less if you take advantage of our package offer).

The MTX NewWord Package price of £645.00 includes a Memotech DMX80 Dot Matrix Printer, MTX NewWord on ROM and an 80K MTX512 micro.

The package will run other types of software like Memotech's MTX Accounting Package and programs in the First Lessons educational series (not to mention Goldmine and Kilopede!).

COMMANDS AND FUNCTIONS

^A	cursor word left
^B	align paragraph
^C	scroll down screen
^D	cursor right
^E	cursor up
^F	cursor word right
^G	erase to the right
^H	erase to the left
^I	cursor to tab
^J	help
^KD	save file
^KQ	abandon changes
^KS	save and resume
^L	find/replace again
^M	carriage return
^O	on-screen menu
^OC	centre a line
^OD	print control display
^OI	set tab stop
^OJ	justify on/off
^OL	set left margin
^ON	clear tab stop
^OR	set right margin
^OS	set line spacing
^OX	margin release
^P	print controls menu
^PB	bold print on/off
^PC	pause in document
^PS	underlining on/off
^Q	quick menu
^QA	find and replace
^QC	go to document end
^QF	find
^QR	go to document start
^QY	delete to end of line
^R	scroll up a screen
^S	cursor left
^T	delete a word
^U	escape
^X	line down
^Y	dele'e entire line

DOT COMMANDS

.MB	set bottom margin
.MT	set top margin
.OP	omit default page nos.
.PA	page break
.PC	set page number col.
.PL	set page length
.PN	set page number
.PO	set page offset
..	comment line

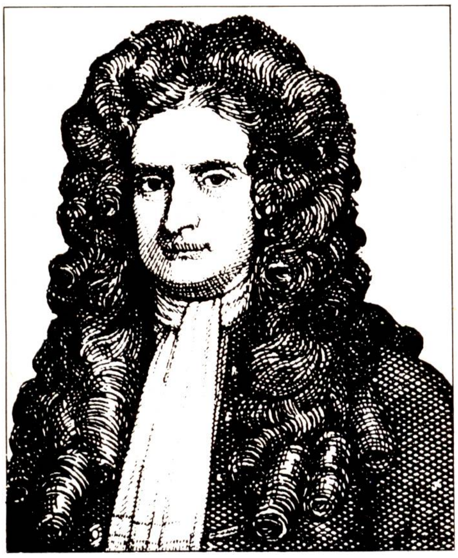
OPENING MENU

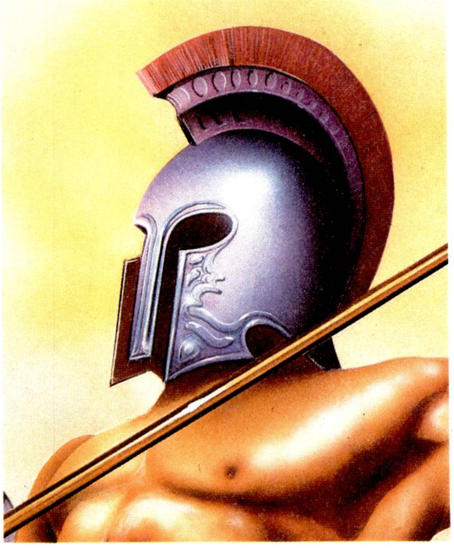
X	Exit
J	Help
D	Load a document
C	Create a document

OTHER MENUS

^O	Onscreen Format
^Q	Quick menu
^K	Save & printing
^P	Print controls
^J	Help pages

k software, from
wton to Nemo.....





MEMOTECH EDUCATIONAL SOFTWARE

Memotech are currently producing two separate series of educational software. They are written for two age ranges; The FIRST LESSONS series covers ages four to seven years and the MATHS and PHYSICS series (each in four parts) cover seven years old up to "O" Level standard.

1st LESSONS is designed to teach younger children the basics of letter and word recognition, with option menus providing the parent or teacher with full control over the program's complexity and reward levels. The child is rewarded with full colour high resolution displays for the right answers.

The MATHS and PHYSICS series are each designed to provide constructive revision texts, and contain animated diagrams, and facilities to go straight to a desired topic.

MEMOTECH MINI PROGRAMS

Memotech Mini Programs are designed to provide a starting point from which the programmer can expand and/or alter the listings to suit his or her particular application. Below is a list of currently available titles:

BUSINESS
CALCULATOR BANK ACCOUNT TYPEWRITER

MATHS & STATISTICS
MATRIX ALGEBRA
INTEGRATION
STANDARD DEVIATION
TWO WAY ANALYSIS OF VARIABLES
TESTS OF SIGNIFICANCE

UTILITIES
RENUMBER MERGE
40 COL. TEXT/GRAPHICS SCREEN
DATA SAVE/LOAD
BINARY/HEX/DEC CONVERTER
SPRITE GENERATOR

TEACH YOURSELF MTX BASIC
GRAPHICS I (PLOT, LINE, DRAW, ETC.)
GRAPHICS II, (ANIMATION)
HOW TO USE MTX ROM RESTART COMMANDS
ASSEMBLER (INTRODUCTION)
SOUND VIRTUAL SCREENS

GENERAL PURPOSE
CHARTS AND GRAPHS
CONVERTER–CURRENCY, LENGTHS, ETC.
SCIENTIFIC CALCULATOR
BRIDGE SCORER
DIARY
ADDRESS BOOK

MEMOTECH ACCOUNTS PACKAGE

The Memotech Accounting Package is a complete set of programs designed for the small to medium sized business (up to 170 employees when used on an MTX512). There are six programs in the series.
The **Payroll** program, for example, handles all necessary calculations to produce wage slips and maintain employee records, and also works out denominations and quantities of notes and coin required for cash paid employees.
Other programs in the series are **Sales Ledger, Purchase Ledger, Nominal Ledger, Bank Account** and **Fixed Assets.**

If you would like to learn more about how Memotech can help you at home or in the office please fill in the coupon below, or ring us for more information. We will be happy to send you an MTX NewWord manual on request.

MEMOTECH

Memotech Limited
Station Lane Industrial Estate,
Witney, Oxon. OX8 6BX.
Telephone (0993) 2977

Please supply the following:

☐ **MTX Newword** Packages at £645.00 inc. VAT
☐ An **MTX Newword** Manual only
☐ Further information on the MTX Series

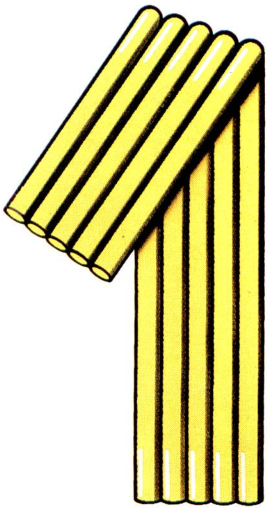
NAME TELEPHONE
ADDRESS
POST CODE
I enclose a cheque for
Please debit my Access/Barclaycard Account, No:
SIGNATURE

Memotech Limited, Station Lane Witney, Oxon. OX8 6BX Telephone (0993) 2977.

MTX 500 - VOTED
PRODUCT OF THE YEAR
BY COMPUTER TRADE ASSOCIATION

MEMOTECH MTX SERIES

Unicorn. Five new c
Here's the ful

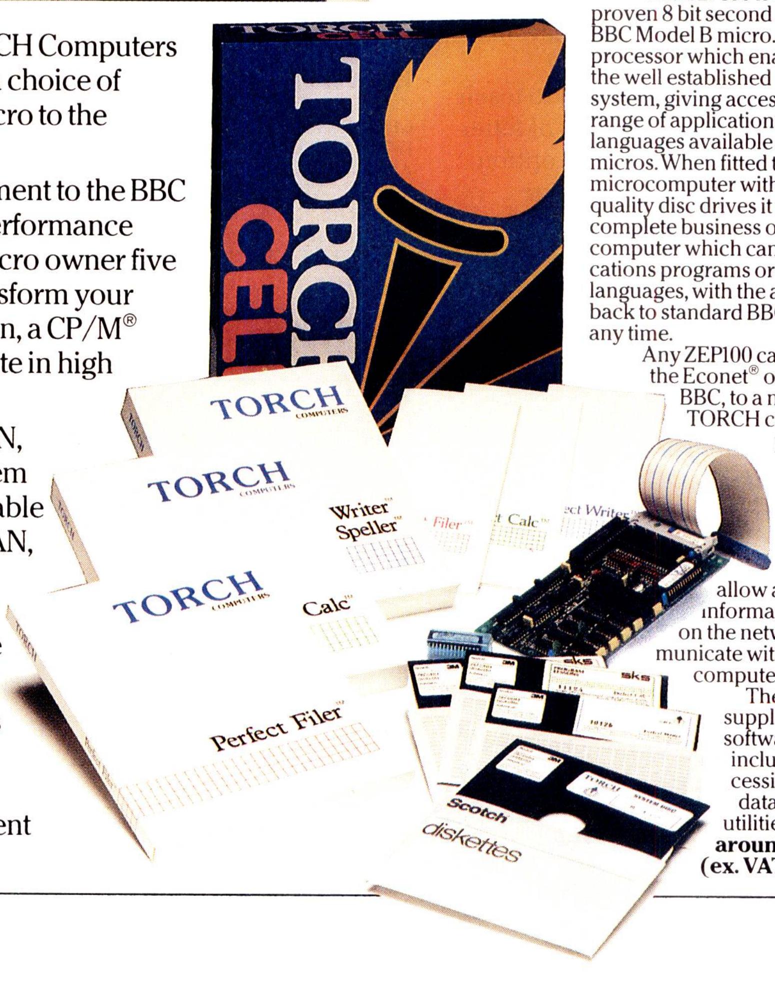


The new UNICORN range from TORCH Computers gives the enthusiast and professional user a choice of upgrades which takes the BBC Model B Micro to the ultimate height of performance.

The result of TORCH'S total commitment to the BBC Micro is the only complete range of high performance hardware available. Offering every BBC Micro owner five new upgrade channels, UNICORN will transform your BBC into a fully communicating workstation, a CP/M® compatible business machine or the ultimate in high powered 32-bit data processing.

At the top of the range, THE UNICORN, offers the power and sophistication of System III UNIX® whilst other channels make available the flexibility of languages such as FORTRAN, PASCAL, BCPL and COBOL. All models, with the exception of the HDP240, provide BBCBASIC(Z80) on the Z80 rather than the Model B's 6502.

Tune in to the Channel that most suits your requirements. Whichever level you choose you can be sure of a system with infinitely expandable potential for a confident future in the world of computing.



The ZEP 100

- Z80 Extension Processor
- 4MHz Z80A
- 64K RAM
- 24K ROM

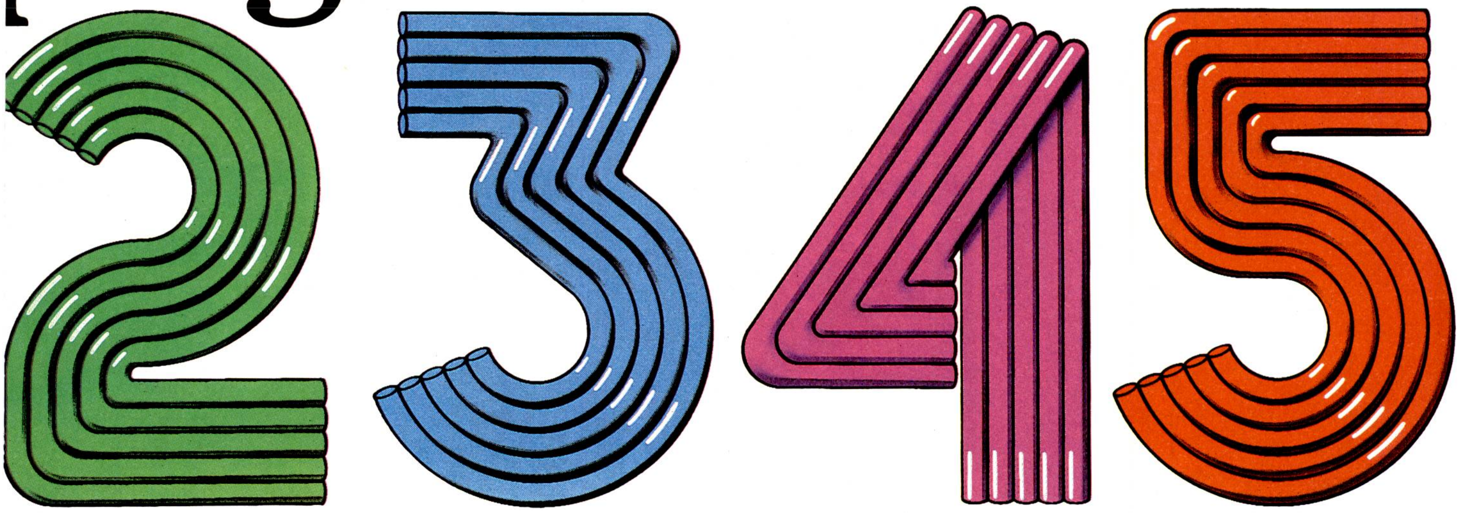
The object of any upgrade kit is to improve processing ability and to increase data storage capacity. The UNICORN ZEP100 is the first stage upgrade which opens channels into the world of serious computing.

The ZEP100 is the proven 8 bit second processor for the BBC Model B micro. A Z80 extension processor which enables the use of the well established CPN operating system, giving access to the vast range of applications programs and languages available for all CP/M® micros. When fitted to a BBC model B microcomputer with compatible high quality disc drives it provides a complete business or scientific computer which can run large applications programs or use advanced languages, with the ability to switch back to standard BBC programs at any time.

Any ZEP100 can be linked, via the Econet® option on the BBC, to a network of other TORCH computers to provide a workstation running on TORCHNET. Full TORCHNET operating systems software is provided to allow access to information anywhere on the network, or to communicate with other computers.

The 64K ZEP100 is supplied with full software support including word processing, spreadsheet, database and utilities. **The ZEP100 – around £299 (ex. VAT).**

hannels for the BBC.
programme.



The ZDP 240

- **4MHz Z80A ● 64K RAM**
- **24K ROM**
- **Twin, double sided 400K floppy discs**
- **Independent integral power supply**

The UNICORN ZDP240 (Torch Z80 Disc Pack) is the proven upgrade for the BBC Model B microcomputer. Offering the use of more powerful and flexible languages such as Fortran, Pascal, BCPL and Cobol, it provides 800K of disc storage plus a Z80 second processor with 64K RAM running TORCH's own CP/M® compatible operating system based in ROM.

This advanced design means that almost all of the 64K RAM provided by the Z80 board is available for CP/M® programming use – an advantage no other BBC micro upgrade can offer.

If your BBC micro has the Econet® option, there is a further benefit the ZDP240 can offer. TORCHNET can link together up to 254 upgraded Model B's on a local area network, so for enthusiasts, Clubs and Schools it is a simple and low-cost way to achieve networking facilities.

The discs can be used for storage under the Acorn DFS system or for CP/M® programs and data.

A comprehensive software package is provided with the disc pack. It includes word and data processing and a spreadsheet program, along with utility programs and manuals.

The TORCH Z80 Disc pack is recommended by the CCTA for government use. **The ZDP 240 – around £699 (ex. VAT).**

The HDP 240

- **20Mbyte hard disc Winchester**
- **Double sided 400K floppy disc**
- **Integral power supply**

For users who need much more storage capacity than is available on floppy discs and who require the large speed gains that a Winchester hard disc provides, the third new channel is now available.
The UNICORN HDP240 combines a 400K floppy disc drive with a 20Mb hard disc and its associated controller. The pack connects directly to the disc and 1MHz bus sockets on the BBC Model B.

In conjunction with a ZEP100, it provides a powerful business computer for running CP/M® programs with large amounts of data. The floppy disc can be used for storage with the Acorn DFS system, and both discs can be used by other TORCH systems on the TORCHNET local area network. **The HDP240 – around £1995 (ex. VAT).**

The HDP68K

- **8MHz MC68000 ● 6MHz Z80B**
- **256K RAM (68000)**
- **64K RAM (Z80)**
- **20 Mbyte hard disc Winchester**
- **Double sided 400K floppy disc**
- **Integral power supply**

The fourth channel in the UNICORN range is for users who need the extra processing power of a 68000 32 bit processor, as well as the Z80 running standard software. The UNICORN HDP68K provides the ultimate in performance, offering an extra 256K RAM and a 68000 processor running at 8 million cycles per second. It also contains a Z80 processor to allow the running of existing TORCH software.
The HDP68K – around £2495 (ex. VAT).

The Unicorn

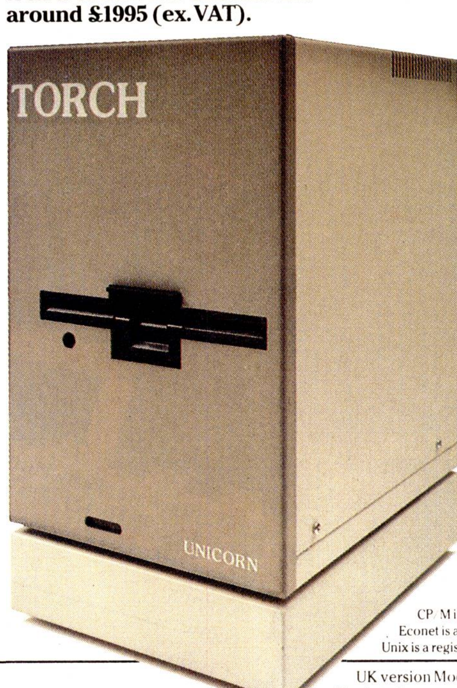
Spec. as HDP68K PLUS UNIX® operating system.

UNIX® System III is the recognised operating system of the '80's. A very powerful and sophisticated multi-tasking system, it includes a vast library of utility programmes.

The fifth channel and top of the range, THE UNICORN, puts UNIX® within reach of the individual user, at a price unmatched by any other UNIX® systems, by combining the reliability of the BBC micro with advanced technology from TORCH Computers.

TORCH UNIX operates under the network operating system. Using UNICORN products, a low-cost network of BBC Micros can be configured to offer the most complete range of educational computing facilities available anywhere.

Other facilities available include UCSDp-System, LISP, FORTH, PILOT and PROLOG. **The UNICORN – around £2895 (ex.VAT).**



UNICORN

Open channels for the BBC micro.

To: Torch Computers Ltd., Abberley House,
Great Shelford, Cambridge CB2 5LQ.
Telephone: Cambridge (0223) 841000.

Please send further information on the UNICORN range plus your FREE 1984 Software Catalogue.

Name

Address

Tel Post Code

CP/M is a registered trademark of Digital Research Inc.
Econet is a registered trademark of Acorn Computers Ltd.
Unix is a registered trademark of Bell Telephone Laboratories Inc.

TORCH COMPUTERS

UK version Model B necessary.
Disc interfaces are necessary for use with the Unicorn range.

Text and Graphics provided by BBC Model B.
Keyboard provided by BBC Model B.

GO 4th WITH NATIONWIDE

apricot

Incorporating Sirius Nationwide
5Mb 10 Mb now available

The FIRST, Fourth Generation Personal Computer

Foremost distributors of the U.K.'s best-selling ACT **Sirius** the Nationwide Dealer Group now offer the very latest personal computer product from the ACT stable—Apricot. Designed and manufactured in Britain, Apricot is the first, fourth generation personal computer—a computer that for the first time works with you rather than just for you, hardware and software co-ordinating perfectly.

Apricot's many unique features include: a second screen located on the keyboard, which can be used without the main monitor to provide a truly portable briefcase-size system; a built-in calendar; calculator and time display; revolutionary 3½″ diskettes which are convenient and compact, yet offer increased storage capacity; plus full 16-bit processing, multi-processor architecture and a powerful 256K RAM as standard.

Apricot and Nationwide

Nationwide are one of few specialist suppliers that can offer an Apricot system tailored to your exact needs *and* provide service and support facilities literally anywhere in the U.K.

Nationwide's library of available software covers everything from Word Processing, Database management, Accounting and Finance (including graphics output) to software for specific businesses and professions. And expert Nationwide staff will make sure you choose the software that is just right for you.

If you'd like to talk to Nationwide about an Apricot computer system, clip the coupon or telephone the nearest Nationwide Dealer listed here...there's probably one right on your doorstep.

Bristol
Business World Ltd.
0272 277104

Cambridge
Anglia Business Computers Ltd.
0223 315580

London Central
Spiro Microcomputers Ltd.
01-499 1608

London N, NW, W, SW
Thames Micros Ltd.
01-561 3636

Solihull
Taylor Wilson Systems Ltd
056 45 6192

Surrey
Carville Computer Services Ltd.
0306 881681

Hull
Micro Supplies Ltd
0482 28811

Northern Ireland
Northern Ireland Computer Centre Ltd
02317 6548

Reading
PPM Micros Ltd.
0734 508787

West Bromwich
Isis Ltd
021-525 7605

Middlesex
Wilson Hughes & Partners Ltd.
0895 53332

West Lothian
Holdene Ltd
0506 827506

Leeds
Holdene Ltd
0532 459459

Manchester
Holdene Ltd
0625 529486

Full range of **Sirius** also available at the above locations.

To: Nationwide, Bray House, Leicester Place, Leeds LS2 9BH. Tel: (0532) 459459
I would like to know more about Apricot microcomputer systems.
Name: ______ Position: ______
Company: ______
Address: ______ Telephone: ______

NATIONWIDE DEALER GROUP

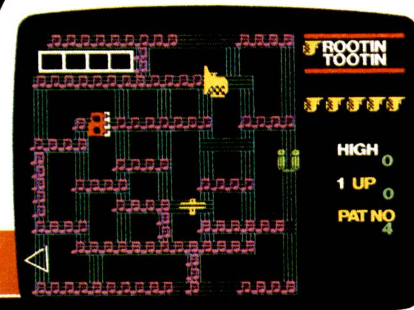
*Price shown is for Apricot with two S/S Disks plus monitor. VAT excluded.

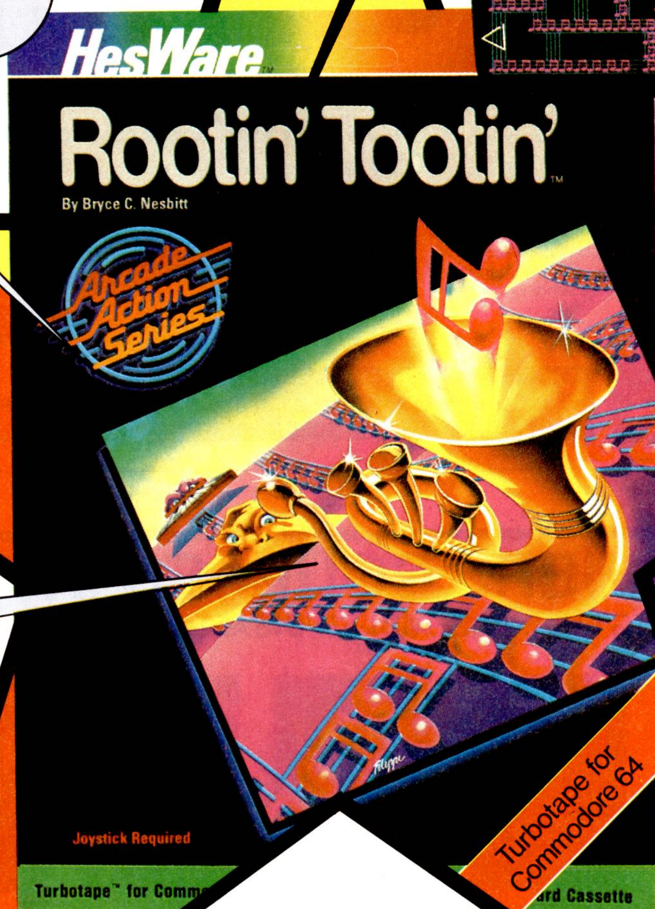
or Commodore 64
and 2 players/joystick needed
urbo-cassette
ew from HesWare

Your Tuba-tootin' mad musical chase!

HesWare action play

FOR you: power-toots on your tuba, an invisibility escape-button and 4 lives. AGAINST you: six mad instruments from the Cymbomb to the Pianha, all trying to trap you in a maze of musical notes. BEFORE you: points to score, 4 starting levels, 21 different play-patterns of ever increasing difficulty. POWER PLAY: great graphics and musical sounds.





HesWare Turbotape

All the speed of a disk-drive, but not the cost. This program will load at – amazingly – in under a minute.

For your copy of 'Rootin Tootin'

(Cat. No. HSEE153). Available from all good computer software stockists.

Send me (tick as required)

☐ My local stockist's address

☐ Your full list of games

☐ ____ copy/ies of this game

at £9.95 each £ : p

+ single P&P sum : 30p

Total to send £ : p

Method of payment

By cheque or PO (no cash) made payable to **TECS**

BARCLAYCARD VISA — Buy it with Access

☐ By Access or

☐ Barclaycard

Enter card no. Sign below:

Credit card sales: UK buyers only. Response within 21 days.

To: Thorn EMI Computer Software Distributors, 296 Farnborough Road, Farnborough, Hants., GU14 7NF. Phone: (0252) 518364.

Name

Address

APCW1

THORN EMI Computer Software Distributors

COMPUTER SOFTWARE DISTRIBUTORS FOR: CREATIVE SPARKS / HESWARE / IUS / MAINSTREET / TOTL / DATAMASTER / HUMAN EDGE

r VIC-20 8K
lo play
rbo-cassette
ew from HesWare

Can learning really be this much fun?

3 games for the 3-9s!

GAME 1: letters and numbers rain down the screen; the child finds the matching keys before the images escape. GAME 2: colourful objects have to be matched fast by tapping out the right words. GAME 3: words flash on-screen and the child must choose the matching picture. There are 4 different levels of difficulty, with high scores winning bonus rounds.

Computer Keyboard fun

'Kids on Keys' introduces youngsters to keyboard controls, helping them to learn by identifying numbers, letters and words. Colourful graphics, action-deadlines and lively music keep them coming back for more.

HesWare Turbotape

All the speed of a disk-drive, but not the cost. This program will load at – amazingly – in under a minute.

For your copy of 'Kids on Keys'

(Cat. No. HSEA 43). Available from all good computer software stockists.

Send me (tick as required)

☐ My local stockist's address

☐ Your full list of games

☐ ____ copy/ies of this game

at £14.95 each £ : p

+ single P&P sum : 30p

Total to send £ : p

Method of payment

By cheque or PO (no cash) made payable to **TECS**

BARCLAYCARD VISA / Buy it with Access ☐ By Access or ☐ Barclaycard

Enter card no. Sign below:

Credit card sales: UK buyers only. Response within 21 days.

To: Thorn EMI Computer Software Distributors, 296 Farnborough Road, Farnborough, Hants., GU14 7NF. Phone: (0252) 518364.

Name

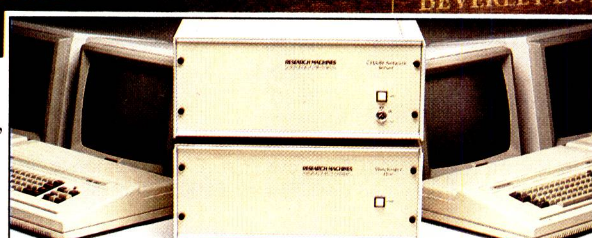
Address

APCW2

THORN EMI Computer Software Distributors

COMPUTER SOFTWARE DISTRIBUTORS FOR: CREATIVE SPARKS / HESWARE / IUS / MAINSTREET / TOTL / DATAMASTER / HUMAN EDGE

CAN THERE BE A MORE POWERFUL ARGUMENT THAN OUR 600 INSTALLED NETWORKS?



RML CHAIN NETWORK
THE NETWORK THAT GIVES YOU MORE

The computer has made itself at home in our offices, laboratories and classrooms.

In fact, the big problem today is providing enough hands-on facilities for everybody. That's why so many schools, colleges and businesses are installing computer networks, to distribute the computer facilities cost-effectively to more users at a time.

At least, that's the theory.

THE RML CHAIN NETWORK - SIMPLICITY ITSELF

In practice, an effective local area network can be hard to achieve if the machines you start with were originally designed for single-user home computing (as many institutions have already learned). They need extra chips, special clock boxes and power supplies, and often liberal use of the soldering iron.

THE RML CHAIN NETWORK IS DIFFERENT

With its powerful 380Z server unit and high-specification 480Z work stations, you can get it up and running without any exotic bolt-on extras.

You'll find it easy to use, fully-interactive, and above all reliable.

In fact, the CHAIN network will support up to 16 simultaneous users at a lower all-in price than competitors' machines with far inferior performance.

UNIQUE UPGRADE PATHS

The RML microcomputer system evolves effortlessly from stand-alone station into multi-user configuration.

En route to the full CHAIN network, our new Shared-Disc System provides low-cost facilities to several users simultaneously from one disc-drive unit.

So if you are thinking of a multi-user upgrade, look at the RML CHAIN network before you buy.

It's the one that has proved itself - 600 times over.

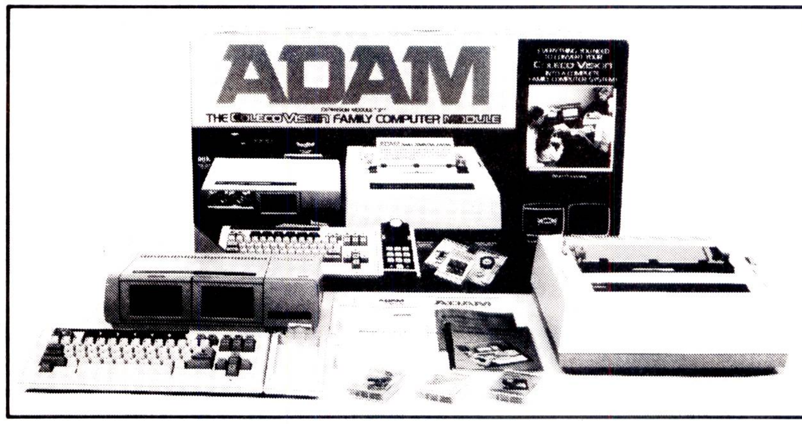
For details contact Tina Davies at the address below.

RESEARCH MACHINES
MICROCOMPUTER SYSTEMS

Sales Office: Mill Street, Oxford.
Tel. Oxford (0865) 249866

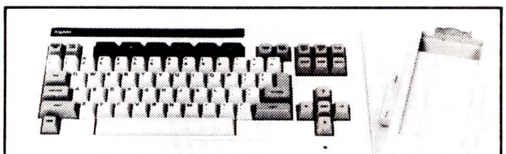
A COMPLETE PACKAGE - ALL THIS FOR £499!

* 80K* RAM (Exp to 144K)
* Full Stroke Keyboard
* 256K Data Storage Unit
* Daisywheel Printer
* Built-in Word Processing
* Buck Rogers Arcade Game
* Colecovision Compatible

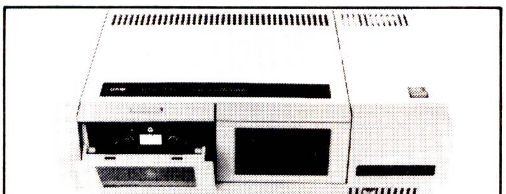


ADAM™ - £499

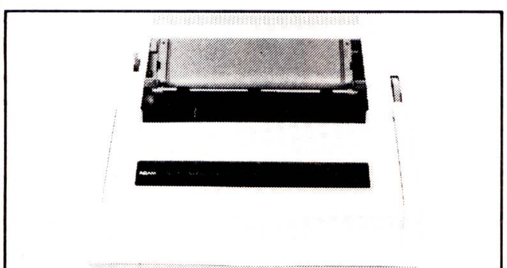
Inc VAT



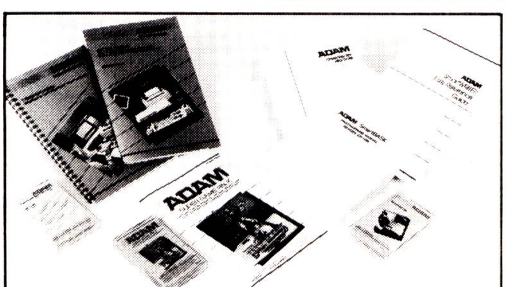
75 KEY FULL STROKE KEYBOARD



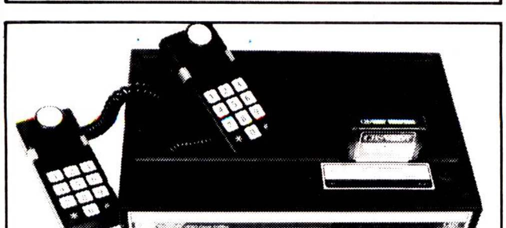
MEMORY CONSOLE & DATA DRIVE



DAISYWHEEL PRINTER



COMPREHENSIVE INSTRUCTIONS



COLECOVISION GAMES CONSOLE

QUITE SIMPLY - VALUE FOR MONEY!

If you're looking for real value in a computer system, one which can handle anything from serious Word Processing to enhanced Colecovision style video games such as Buck Rogers, look no further. The Coleco Adam is here with a package which will make you wonder if you're dreaming when we tell you about it. A price breakthrough in computer systems, Adam is comprised of an 80K RAM memory console with a built-in 256K digital data drive; a professional quality, stepped and sculptured 75 key full-stroke keyboard; a letter quality daisywheel printer and a full word processing program built into the Console. Two additional pieces of software, Smart BASIC and also 'Buck Rogers - Planet of Zoom' (the ultimate in advanced video games), are included as well as a blank digital data pack. Adam can be used with any domestic colour Television set.*

MEMORY CONSOLE/DATA DRIVE: *The heart of the Adam system is the 40K ROM and 64K RAM memory console which combines with the 32K ROM and 16K RAM in Colecovision to give you a total of 72K ROM (including 24K cartridge ROM) and 80K RAM (expandable to 144K). Built into the memory console is a digital data drive which accepts Adam's digital data packs, a fast and reliable mass storage medium that is capable of storing 256K of information, that's about 250 pages of double spaced text! The console is also designed to accomodate a second optional digital data drive.

FULL STROKE KEYBOARD: The Adam keyboard has been designed as a professional quality keyboard that combines ease of use with an impressive array of features. It is stepped and sculptured for maximum efficiency and has 75 full stroke keys which include 6 colour coded Smart Keys which are redefined for each new application; 10 command keys which are dedicated to the word processing function, and 5 cursor control keys for easy positioning of the cursor at any point on the screen. You can attach a Colecovision controller to the keyboard to function as a numeric keypad for easy data entry. It can also be held like a calculator, a feature which makes working with numbers particularly easy. The joystick part of the hand controller can be used in the same way as the cursor control keys, to move the cursor around the screen.

LETTER QUALITY PRINTER: The SmartWriter letter quality daisywheel printer is a bi-directional 80 column printer which prints at a rate of 120 words per minute. It uses standard interchangeable daisywheels, so a variety of typestyles are available. The printer has a 9.5 inch wide carriage for either single sheets or continuous fan fold paper and uses standard carbon ribbons. It is comparable to many printers which cost as much as the total Adam package. The printer can be used either with the Adam's SmartWriter word processing program or as a stand alone electronic typewriter.

BUILT-IN WORD PROCESSOR: Adam comes with SmartWriter word processing built-in. This program is so easy to use that you only have to turn the power on and the word processor is on line and ready to go. Detailed instruction books are not necessary as the Computer guides you step by step, working from a series of Menu commands. It enables you to type in text, then completely edit or revise it with the touch of a few keys. Changes are readily made and a series of queries from the computer confirm your intentions, so that you can continuously double check your work as you type.

COMPATIBILITY WITH COLECOVISION: By using high speed interactive microprocessors in each of the modules, the Coleco Adam is designed to take additional advantage of both the 32K ROM and 16K RAM memory capability in the Colecovision. If you do not already own a Colecovision Console (£99 inc VAT), then you will need to purchase this when you initially purchase your Adam Computer package (£499 inc VAT), making a total purchase price of (£598 inc VAT).

WHAT IS COLECOVISION: Colecovision is one of the worlds most powerful video game systems, capable of displaying arcade quality colour graphics of incredible quality on a standard Colour TV set. The console (see picture bottom left) accepts 24K ROM cartridges such as Turbo and Zaxxon and is supplied with the popular Donkey Kong cartridge and a pair of joystick controllers. Colecovision has a range of licenced arcade hits available such as: Gorf, Carnival, Cosmic Avenger, Mouse Trap, Ladybug, Venture, Smurf, Pepper II, Space Panic, Looping, Space Fury, Mr Do, Time Pilot, Wizard of Wor and many others. So there you have it, Adam plus Colecovision the unbeatable combination. Send the coupon below for your FREE copy of our 12 page Colour brochure giving details on the complete Adam system.

SILICA SHOP LTD., 1-4 The Mews, Hatherley Road, Sidcup, Kent, DA14 4DX Tel: 01-309 1111 or 01-301 1111

ORDER NOW - OR SEND FOR A FREE COLOUR BROCHURE

To: SILICA SHOP LTD, Dept WMI 0784, 1-4 The Mews, Hatherley Road, Sidcup, Kent, DA14 4DX Telephone: 01-309 1111 or 01-301 1111

LITERATURE REQUEST:

☐ Please send me your FREE 12 page colour brochure on Colecovision/Adam

☐ I own a .... Videogame ☐ I own a .... Computer

Mr/Mrs/Ms: .... Initials: .... Surname: ....

Address: ....

....

....

.... Postcode: ....

ORDER REQUEST:

Please send me: ☐ Adam (add-on package only) .... £499 inc VAT

☐ Adam & Colecovision (£499+£99) ..... £598 inc VAT

☐ I enclose Cheque/P.O. payable to Silica Shop Limited

☐ CREDIT CARD - Please debit my Access/Barclaycard/Visa/Am Ex/Diners Club

Card Number: ....

Rev 2

2 NEW BUSINESS SOFTWARE PROGRAMS FOR THE BBC MICRO

MAIL LIST £49.95 inc VAT & p/p

STOCK CONTROL £49.95 inc VAT & p/p

HUGE STORAGE CAPACITY
UP TO 1600/3200 FULL ENTRIES

FAST WRITE AND READ CAPABILITY

EASY UPDATES AND AMENDMENTS
WITH COMPREHENSIVE MENU

FULLY AUTOMATIC ALPHA-SORTING

VERY USER FRIENDLY

FULL COLOUR GRAPHICS UTILISED

EASY TO FOLLOW USER GUIDE MANUAL

DISK ONLY ✪ PRICES INCLUDE VAT & DELIVERY BY REGISTERED MAIL WITHIN 10 DAYS
EITHER PROGRAM £49.95 ✪ BOTH TOGETHER £90 ✪ STATE SINGLE OR DOUBLE DRIVE, 40/80 TRACK
CHEQUE/P.O. PAYABLE TO MLC COMPUTERS LTD ✪ FULLY GUARANTEED

DEALER ENQUIRIES WELCOME

MLC

PEAR TREE MEADOW ✪ ELLINGTON THORPE ✪ HUNTINGDON ✪ CAMBS ☎ 0480-811573

Sales & marketing management packages FOR IBM PCs

Written in C for full advantage of Data base

STAND NO. 35

- Facilities for interfacing with other packages
- Full control for sales history budgets, account expenditure

ECS

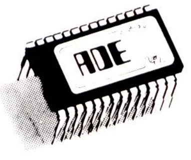
EUROPEAN COMPUTER SERVICES INC

For further details please write or telephone

European Computer Services Inc
1 Charlbert Court
Charlbert Street
London NW8 7BX
Telephone 01-722 1283
Telex 881 3270

SYSTEM SOFTWARE

ROMs FOR THE BBC MICROCOMPUTER



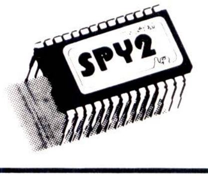
The complete program development package for assembly language programmers. ADE is the de facto industry standard for professional software writers using the BBCmicrocomputer. The 16k ROM contains a full 6502 MACRO assembler; a dynamic text editor; a front panel debugging monitor and disassembler. ADE comes complete with a 160 page comprehensive reference manual and a utility/macro library disc. ADE can also be used with tape based machines.

The ASSEMBLER features macros with library facilities; nestable conditional assembly; flexible listing options (with or without macro expansion); hex, decimal, binary and ASCII data formats; dummy section; full range of arithmetic and logical operators; symbol table sort and dump; file chaining and 29 powerful pseudo ops. Source and object files are kept on disc so there is no limit on program size or location.

The EDITOR is designed with the programmer in mind for writing both programs and documentation. The editor includes a very powerful command language (including macros) that enables much editing to be done on a semi-automatic basis. It features full screen editing and deferred edit modes; no limit to document size; edit with backup facilities and a versatile text formatter.

The DEBUGGER is instantly accessible for inspecting, modifying and disassembling machine code programs. Features include full 64 byte display in hex, ASCII and disassembled format; registers; stack; single step; breakpoints; memory search and much more.

Price £60 inc vat. Please specify 40 or 80T utility disc.



SPY2 is a front panel debugging monitor, disassembler and disc utility ROM. SPY2 is instantly accessible to the programmer for inspecting, modifying, debugging and disassembling machine code programs. SPY2 also features a relocator and program trace facilities. SPY2 will access any ROM either in the sideways ROM sockets or on an extension board. ROM memory may be displayed, single-stepped through or disassembled.

SPY2 includes a set of powerful disc recovery commands for interrogating, editing and retrieving data stored on a floppy disc. SPY2 also includes a disc formatter as well as a non-destructive single track reformatter.

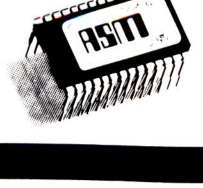
In all SPY2 has a comprehensive set of 23 utility commands. These are supported by an excellent Reference Manual.

The SPY2 front panel encompasses all the superb, easy-to-use facilities of the renowned SPY debugging monitor PLUS additional commands for toggling and finding breakpoints; relocating machine code programs; single stepping through subroutines in one go and facilities for accessing the front panel from programs in RAM or ROM with breakpoints, OSBYTE or CTR-F.

SPY2 features a versatile disassembler with hex dump, full and intelligent disassembly. This identifies data areas in the program; these being displayed as a hex/ASCII dump. Operating system calls are labelled creating very readable code. The powerful trace facilities enable program instructions and register contents to be traced to printer whilst the program is running. Indispensable for graphics programs as they can be stepped through whilst observing the effects on the screen.

SPY2 features a disc sector editor displaying the contents of a whole sector; disc search facilities for finding byte patterns or strings and free disc space. Files may be recovered by creating a directory entry with all the data concerning the deleted file. Directory entries can be easily amended using the *AMEND command. The *FORMAT command formats discs with any number of tracks. A verify command checks discs. The *REFORMAT command is extremely useful for recovering information from a bad track, reformatting it and restoring the data. Commands are included for loading files at &1900 and automatically downloading (and running) them.

The most comprehensive of all debugging/disc utility ROMs. **Price £30 inc vat.**



ASM provides all the superb features of the ADE macro assembler on its own ROM.

The program source file may be written using any editor (even Wordwise or View!). Complete with reference manual and utility/macro library disc. Use the assembler that professional software writers use.

Price £35 inc vat. Please specify 40 or 80T utility disc.

SYSTEM Dept P 12 Collegiate Crescent, Sheffield S10 2BA

TC 299

ADVERTISERS INDEX

MICROMART ADVERTISERS INDEX

CHIP CHAT

Acornsoft, the locksmith of the computer industry, is using the 'it takes a thief to catch a thief' theory to test its new *PCW*-proof software locking device — it has employed somebody to try to break it. ChipChat can exclusively reveal that the somebody has now broken it. If you want a copy of the routine all you have to do is rearrange the 3rd, 5th and 17th lines of the programs in this month's Programs section.

★ ★ ★

On the subject of piracy, a certain software house claims that for every copy of its games sold there are seven pirated versions. To protect themselves from being scuppered by the pirates, software houses are forming guilds and associations by the dozen. The latest is the Association of Oric Software Houses, no doubt with St Anthony as its chairman (St Anthony is the patron saint of lost causes). If this trend continues and the proliferation of guilded associations and associated guilds goes unabated, ChipChat predicts that in two years' time, for every game you buy, there will be at least seven associations.

★ ★ ★

Microdeal's latest anti-pirate scheme is to sell its top games with a dongle. The dongle in question is a small circuit board encased in resin which must be plugged into the joystick port before the game will load. ChipChat can reveal that as the resin contains aromatic solvents, the dongle isn't really an anti-pirate device but an attempt to make Microdeal's games more addictive.

★ ★ ★

Quantum Leap Systems has leapt on the 'put it in a black box' bandwaggon by announcing its 4QL peripherals. This should serve as a warning to all, as they will not be the last QL-compatible product on the market where 'QL-compatible' means somebody else's product painted black.

★ ★ ★

John Bowring has installed his company's Radionic CNS micro at home and it has transformed his life. Early every morning a sexy voice whispers in John's ear telling him that it's time to get up. If he doesn't stir, it gradually gets more aggressive until it eventually shouts at him, draws the curtains, turns on the lights and plays raucous music until he retaliates by shouting back.

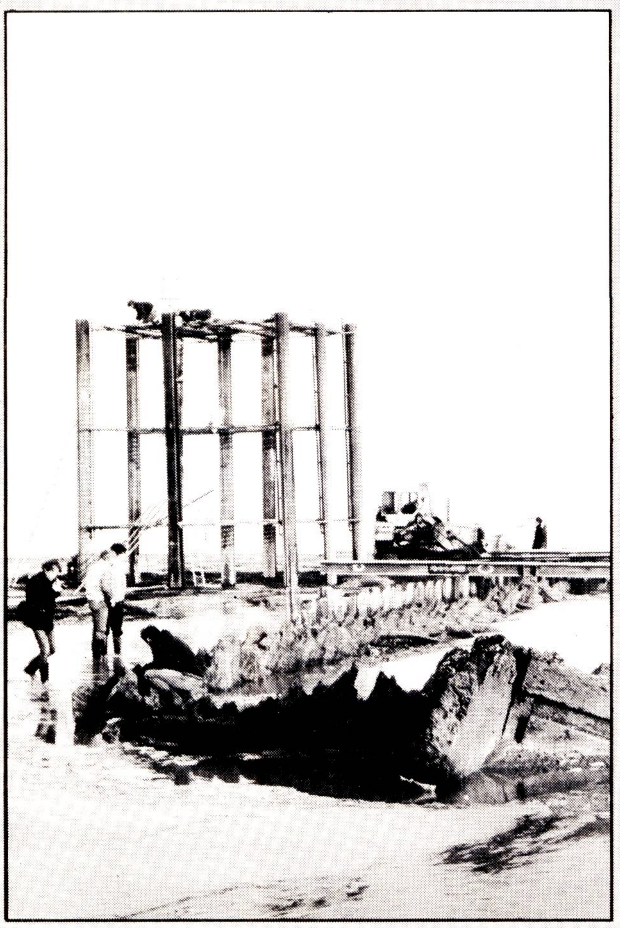
A ChipChatter has discovered that John lives alone. With all that aggro going on we're not surprised.

BLUDNERS

In our June issue we renamed Roger Moffatt (CP/M Access) 'Richard'. Our apologies.

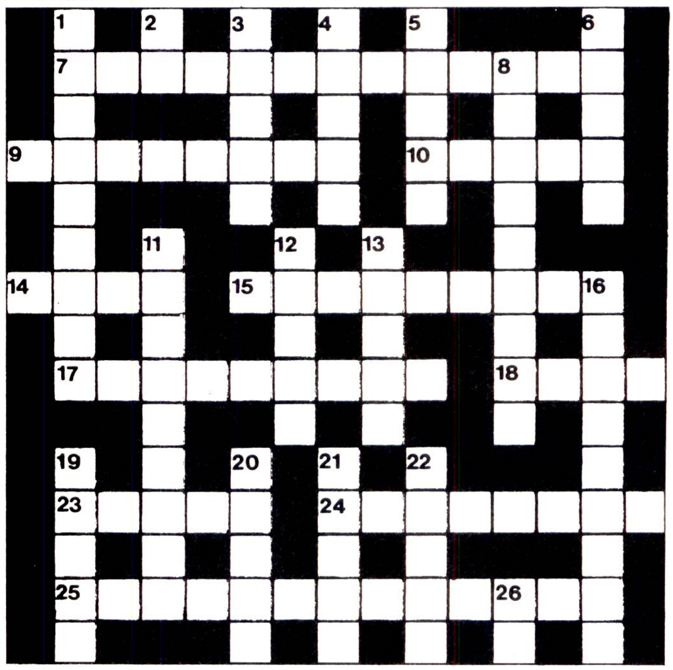
Just to confuse you, the answers to the February Prize Puzzle in the May issue (page 238) were incorrect. They should have been 46.3in, 33.7in and 11.3in.

The 'Atari stock market' program printed in the June issue is for a 32k machine — sorry, we should have stated this.



Kingsway Data Systems has lent a Philips P2000C micro to the team excavating the wreck of the 18th century ship, the Amsterdam. This photograph shows the entire excavation team searching for a place to plug in the micro. Note the enterprising gentleman on top of the scaffolding who is about to unplug the table lamp and plunge the whole area into darkness.

PRIZE CROSSWORD



Submit your entry to *PCW* by 19 July. You could win £10!

CLUES ACROSS

7 Attractive software may come in packs (8,5)
9 Apply for a special location (8)
10 Sailor in first rate company (5)
14 Interrupt during brutish altercation (4)
15 Drug count being useful though gibberish (4,5)
17 Man of the church getting into home improvements from the dictionary (9)
18 It may be driven in the restaurant (4)
23 Note live appearance of Sinclair (5)
24 Our metal construction facilitates portability (8)
25 3,10,24,7 and 11, for example (6,7)

CLUES DOWN

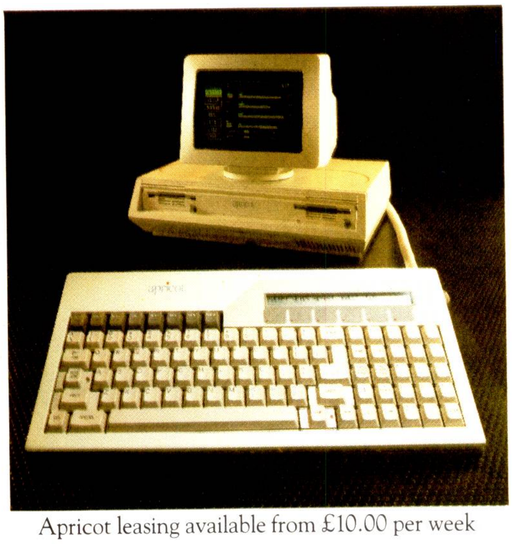
1 Headless tent dwellers and this! (9)
2 A mercurial clue . . . (2)
3 Females to lose out on drinks, but only a very small number (5)
4 Apple or apricot (5)
5 The perfect clue . . . (5)
6 It's fairly standard and of character (5)
8 Begin to send up a synonym of acceleration time (5,4)
11 Tear into one about repetition (9)
12 Something not very nice on video (5)
13 The integrated generation (5)
16 Interference commonly on the blower (4,5)
19 Company with a hackneyed name? (5)
20 Neither apple nor apricot and not quite lemon (5)
21 Clothes handed down the generations, we hear (5)
22 A record to keep the babies quiet (5)
26 An exemplary clue . . . (2)

June winner: Jenkins, Fulham, London SW6

For every business problem we've got a digital solution

ACT Sirius 1 leasing available from £12.00 per week

Fortune leasing available from £27.00 per week



Apricot leasing available from £10.00 per week

From the smallest to the largest application our knowledgeable staff will provide the most efficient and cost-effective solution from our comprehensive range of six computers, fifty makes of printer and several hundred software packages.

Our leasing schemes save the burden of capital cost and our new interest-free credit plan offers even greater savings.

Call us today for advice – or send for our price list. You will find the service you expect from a leading computer company.

Digital Solutions Limited
The Coach House, The Broadway, St Ives
Cambs PE17 4BX
Telephone Huntingdon (0480) 300728

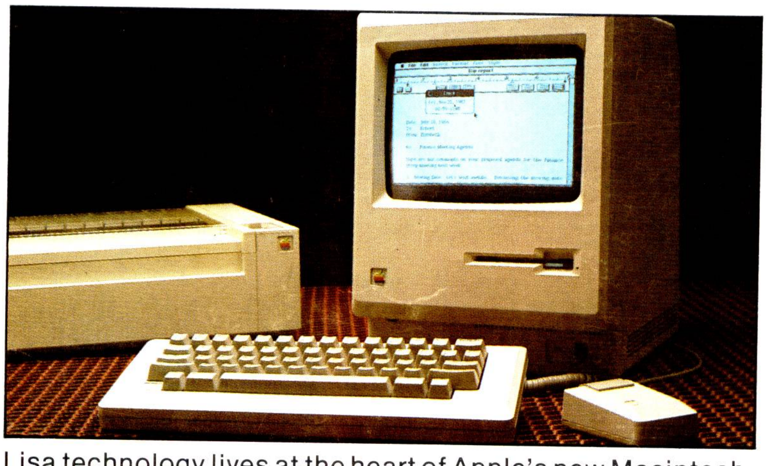
digital solutions

digital™ IBM FORTUNE FUTURE

..the umbrella is free!

To compliment your Macintosh, when you buy from Personal Computers Ltd, we will give you not one but two umbrellas!

The first will protect you in the wet weather and the second is the reason why 4,000 clients have purchased Personal Computers from us. Why? Because we provide our customers with sound advice and guidance, application software support, hardware maintenance, training and systems consultancy . . . the other Personal Computer Umbrella!



Lisa technology lives at the heart of Apple's new Macintosh, technically that gives you, totally integrated software, windows, icons, pull down menus and mouse based control. Macintosh is powered by the 32 bit state of the art MC68000 processor. It comes complete with a 400k byte micro drive, high resolution screen all contained in an attractive unit that takes less space than your in tray . . . it's truly portable!

Call Personal Computers now on 01-377 1200, be amongst the first to see Macintosh and get your umbrellas!

Personal Computers Ltd.

218 & 220-226 Bishopsgate, London EC2M 4JS, Tel. 01-377 1200, Telex 8954665 ATT PCL

MACINTOSH SEMINARS

Please send available dates to:-

Name...

Co. .... Phone No. ....

Address..

Post:- FREEPOST, Personal Computers, 220 Bishopsgate, London EC2M 4JS